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United States Tariff Commission Collects Data on Plate Glass and Mirror Plate

An Exhaustive Investigation Being Made Into Domestic and Foreign Production Costs, Selling Prices and Other Phases of the Industry

Much Information Already Obtained for Use at Public Hearing on Rate of Duty to Be Held on November 23, at Washington

A preliminary statement of information collected by the United States Tariff Commission in connection with investigations now being conducted by that body with respect to the cost of production of mirror plate and cast polished plate glass was issued on October 22 by John F. Bethune, secretary of the Commission.

Notices dated October 19 had previously been issued of public hearings to be held at the Washington office of the Commission at 10 o'clock a.m., Monday, November 23, 1925, in connection with Investigation No. 26 on cast polished plate glass, and No. 8 on mirror plate, at which hearing all parties interested will be given an opportunity to be present, to produce evidence and to be heard with regard to the differences in costs of production and all other facts and conditions enumerated in Section 315 of the Tariff Act of 1922 with respect to the article described.

These investigations have resulted from applications made on October 6, 1922, by the McKim & Cochran Furniture Company, Madison, Indiana, and on November 14, 1922, by the Buckley-Newhall Company of New York City, requesting a decrease in the duty on plate glass and mirror plates. Investigations under section 315 of the Tariff Act of 1922 on these commodities were ordered by the Tariff Commission on March 27, 1923 (mirror plates), and on May 5, 1923 (plate glass).

In the introduction to the preliminary statement just issued by the Commission the attention of interested parties is particularly directed to the following questions for discussion:

1. Should duties assessed on cast polished plate be graduated according to the size of the pieces imported, as in the Act of 1922, or should one rate of duty be assessed upon all such glass?

2. What are the important distributing centers for plate glass in the United States, both for the imported and the domestic product?

3. Does imported ground and polished cylinder glass compete with thin cast polished plate glass, and if so, to what extent and for what purposes?

The Customs Division of the Treasury Department advised the Commission on March 25, 1924, relative to the practice at the port of New York for classifying such cylinder glass, that:

"There is no special provision in the tariff act for glass which has been ground on the surface and polished and that cylinder glass having the surface or surfaces ground or polished would, when imported, be returned for duty at the rates applicable to cylinder glass polished under the provisions of paragraph 220."

The Treasury Department further advises that it concurs in the practice followed at the port of New York.

The total importations of all polished cylinder glass for 1924, including ground and polished, were 567,763 square feet, as compared with 16,804,848 square feet of cast polished plate glass for the same period.

In this preliminary statement domestic and foreign cost data are submitted for the following periods:

United States, 1922 and first quarter of 1923.

Belgium, fiscal period June 30, 1922, to June 30, 1923.

Germany, January, 1924.

It is requested that consideration be given to the period or periods for which a comparison between domestic and foreign costs of production should be made.

Attention is directed to the fact that this is a preliminary statement only and all figures, comparisons, and conclusions therein contained are tentative and subject to revision.

Costs of manufacture of individual firms and other information in the nature of trade secrets or processes are excluded from this statement, as required by section 708 of the Revenue Act of 1916.

The members of the Tariff Commission are: Thomas O. Marvin, chairman; Alfred P. Dennis, vice chairman;

Edward P. Costigan; Henry H. Glassie; A. H. Baldwin; Edgar B. Brossard; John F. Bethune, secretary.

The complete statement follows:

Part I.—Polished Plate Glass

I. RATES OF DUTY.

Rates of duty per square foot.

	Act of 1922 (Par. 222)	Act of 1913[1] (Par. 88)	Act of 1909 (Par. 102)
Cast polished plate glass finished or unfinished, unsilvered			
Not exceeding 384 sq. inches	12½c	6c	10c
Above 384 sq. in. and not exceeding 720 sq. inches	15c	8c	12½c
Above 720 sq. inches	17½c	12c	22½c

[1] In Act of 1913 the same duties applied to polished plate glass with wire netting; for the other years shown different rates for polished plate glass with wire netting applied.

II. USES.

The expansion in recent years of the plate glass industry is explained by (1) the rapid growth of the automobile industry (2) the displacement of common window glass by plate glass in large office buildings, retail show windows, and in the more modern residences, and (3) the increased use of mirrors.

At present its greatest single use is in automobiles, those manufactured in 1924 requiring approximately 50,000,000 square feet, or 53 per cent of the current production as compared with a consumption for this purpose of 1,771,000 square feet in 1918, 8,700,000 square feet in 1920, and 20,000,000 square feet in 1922.

Other representative uses of plate glass are for mirrors, for deck and port lights on ships, for aquariums, and as protective coverings for desk and table tops. In the manufacture of mirrors the better qualities of plate glass, known as "silvering," are used.

The following thicknesses are standard for:

Automobiles, ⅛ to ¼ inch.
Windows and mirrors, ¼ inch.
Deck and port lights, aquarium and desk tops, ¼ inch and over.

III. PRODUCTION.

A. Raw Materials.

The principal raw materials of plate glass are melting sand, soda, salt cake, lime, arsenic and charcoal. Clay for making crucibles as well as grinding and finishing materials, such as sand, emery, plaster, iron bars, rouge, and felt are essential. For all these materials the United States industry relies exclusively upon domestic sources.

B. Distribution, Organization and Output.

1. *United States.* In 1923 there were 7 companies operating 13 plants; of these plants, 7 were in Pennsylvania, 2 in Michigan, and 1 in each of the following States: Illinois, Indiana, Missouri and Ohio.

Four establishments, owned and operated by a single company, manufactured approximately 50 per cent of the total domestic production. Of the nine remaining plants, 6 have been acquired by automobile interests to supply their own needs.

2. *Europe.* All of the European plate glass companies, with the exception of the American owned establishment at Courcelles, Belgium, and the English firm of Pilkington Brothers, Ltd., at St. Helens, England, are members of an association known as the "International Convention." Since its formation in 1904 this association has been a leading factor in the development of the plate glass industry of Europe. Its purposes are to organize and administer mutual agreements relative to (1) production of the different factories, and (2) the establishment of sales prices for the markets of the world.

The output since 1909 has been as follows:

Table 1—*United States: Polished Plate Glass Production,*[1] 1909-1924.

Year	Square feet	Value	Unit value
1909	47,370,254	$12,204,875	$0.2576
1914	60,383,516	14,773,787	0.2447
1919	56,823,749	33,348,279	0.5869
1921	56,238,783	37,260,559	0.6625
1922	76,678,207[2]	44,158,979[3]	0.5759
1923	94,469,718	65,165,675	0.6663
1924	[4]	[5]	

[1] Source: Census of Manufactures.
[2] *"Glass Industry,"* Vol. 4, No. 3, March, 1923.
[3] Estimated on average sales value for year.
[4] Information from the Plate Glass Manufacturers Association indicates that production for 1924 was over 2 million square feet greater than that of 1923.

[5] *United States: Polished Plate Glass Production*
(Source: *National Glass Budget,* June 6, and August 8, 1925)

Year	Square Feet	Year	Square Feet
1913	51,530,829	1919	48,639,882
1914	58,776,551	1920	76,776,107
1915	62,133,718	1921	53,578,682
1916	69,598,267	1922	67,678,207
1917	60,000,000	1923	89,069,441
1918	52,925,246	1924	91,554,474
		1925 (6 mo.)	56,561 960

a. *Belgium.* The manufacture of plate glass, one of the country's chief industrial products, is centralized in eight factories all within a radius of twenty-five miles from a point midway between Charleroi and Namur in the Valley of the Sambre. Abundance of skilled labor and suitable raw materials in this region have assured the rapid expansion of the industry and have made Belgium first among European countries in plate-glass production. The following table shows the growth of the industry since 1851.

Table 2. *Belgium: Production of Polished Plate Glass*[1] 1851-1923.

Year	Square Feet
1851	215,000
1860	860,000
1878	2,203,000
1888	7,747,000
1894	11,836,000
1899	17,431,000
1906	26,900,000
1913	25,800,000
1922	33,700,000
1923	45,000,000

[1] Source: *Glass Trade* and *Le Verre.*

As a small proportion (6 to 8 per cent) of the output suffices for Belgian requirements, the remainder is sold throughout the world. Recent exports were as follows:

Table 3. *Belgium: Exports of Polished Plate Glass,*[1]

Year	Exports from Belgium to: All countries metric ton	United States Metric tons	Ratio of exports to United States to total exports per cent
1913	38,400	1,505	3.9
1922	30,114	8,127	26.9
1923	60,172	17,322	28.8

[1] Department of Commerce, Bu. Foreign and Domestic Commerce, Special Circular, No. 47, April 21, 1924.

b. *Germany.* The industry has practically regained its pre-war status in Germany. Of the eight factories five are in the formerly "occupied zone." The St. Gobain Company of France, the pioneer of plate glass manufacturing in Europe, has been for many years financially interested in

most of the factories in Germany and now, 1925, controls practically the entire industry.

The following table shows German production:

Table 4. *Germany: Production of Polished Plate Glass*[1] 1905-1923.

Year	Square Feet
1905-1912 average	15,709,000
1913	19,884,000
1921	11,653,000
1922	16,400,000
1923	16,509,000

[1] Source: Verein Deutschen Spiegelglas Fabriken.

In 1923, 5,300,000 square feet or 32 per cent of the German output was exported to the United States, as compared with a domestic consumption of only 4,000,000 square feet, or about 25 per cent of production.

Exports to the United States in 1924 amounted to 3,140,907 square feet.

c. *France.* The principal company producing plate glass in France is "Les Manufactures des Glaces et Produits Chimiques de St. Gobain," with factories located at Montlucon in the south-central part of the country and Boussois, St. Gobain, and Tourot in the north. There is also a small plant at Maubeuge in northern France owned by the English firm of Pilkington Bros., Ltd.

The St. Gobain factories produced in 1923 slightly over 3 million square feet of polished plate glass, of which 214,158 square feet, or approximately 7 per cent was exported to the United States.

Practically all of the plate glass produced in France is used in the automobile industry of that country and in reconstruction work.

d. *England.* In the last half century most of the plate glass manufacturers of England have been forced out of business by foreign competition. In 1923 there was only one plant in operation, that of Pilkington Brothers, Ltd. of St. Helens. The industry is handicapped for raw materials, particularly melting sand, which it must import from Belgium, since there are no large deposits in England. Production in 1923 amounted to approximately seven million square feet. Exports to the United States were one million square feet in 1923 and about one and one-half millions in 1924.

IV. UNITED STATES FOREIGN TRADE.

1. *Imports.*

Imports of cast polished plate glass in 1914 amounted to 3,000,000 square feet (4.9 per cent of the domestic production) valued at $728,000. Belgium supplied more than 90 per cent of the imports which consisted largely of the finer and more expensive grades used in mirrors. Prior to the World War American mirror manufacturers imported 75 per cent of their requirements of plate glass, the foreign glass being in demand because of its superior quality. During the war, when importation practically ceased, domestic production was more than sufficient for home consumption, as is shown by the great increase in exports at that time.

With the resumption of European production in 1919 and 1920, particularly in Belgium, a new supply was created and the world shortage then existing was considerably reduced. In 1921, imports were again 3,000,000 square feet, or 5.5 per cent of domestic production.

The unprecedented demand for plate glass since 1922 resulted from the great commercial expansion in the automobile and building industries beginning in the late summer of 1922. As domestic producers were unable to meet orders, imports from Europe increased rapidly.

The following table gives a summary of import statistics for 1922-1924:

Table 5. *United States: Imports for consumption of Polished Plate Glass* 1922-1924

Year	Square feet	Per cent imported from: Belgium	Germany	Other countries	Percentage imports are of domestic production
1922	10,500,000	70	20	10	14.0
1923	26,000,000	60	20	20	28.8
1924	16,800,000	56	19	25	17.7
1925 (6 mo.)	8,266,567	56	13	31	14.6

The following tabulation indicates approximately the quality of the 1922 and 1923 imports:

Quality	Per cent of total imports
Ordinary glazing	73.4
Mirror glazing	18.0
Second silvering	8.0
First silvering	.6

Table 6 and chart 1 show the distribution of imports according to the size of the glass.

2. *Exports.*

Prior to the World War domestic exports of plate glass were insignificant, averaging in value less than $50,000 annually. But with the cessation of European production, leaving the United States the main source of world supply, exports in 1917 increased to 6,117,955 square feet, valued at $2,223,000 and in 1919 to 7,300,000 square feet, valued at $4,221,000.

The resumption of production in Belgium, France and Germany created new stocks for export and has resulted since 1919 in the reduction of United States exports. At

Table 6. *United States: Imports for consumption of Polished Plate Glass.* 1909-1924

Year	Area: Less than 384″ Sq. ft.	Per cent of total	384″ to 720″ Sq. ft.	Per cent of total	Above 720″ Sq. ft.	Per cent of total	Total: Sq. ft.	Value	Average value per Sq. ft.
1909	345,560	15.1	1,611,845	70.6	322,527	14.3	2,279,932	$499,885	$0.215
1914	162,155	5.8	1,915,561	67.9	741,891	26.3	2,819,607	631,618	.244
1919	705	16.9	287	6.9	3,181	76.2	4,173	3,055	.73
1920	262,808	10.4	442,904	17.5	1,825,991	72.1	2,531,703	2,228,672	.880
1921	648,537	21.5	1,202,917	39.9	1,163,288	38.6	3,014,742	2,025,828	.672
1922	1,728,253	16.3	3,364,554	31.8	5,535,936	51.9	10,628,743	4,890,536	.461
1923	4,496,320	17.4	7,437,392	28.7	13,984,850	53.9	25,918,562	15,824,655	.616
1924	2,408,006	14.3	5,774,404	34.3	8,622,957	51.4	16,805,367	9,956,309	.592
1925 (6 mo.)	1,344,107	13.5	4,072,874	41.1	4,488,577	45.4	9,905,588	4,755,948	.480

[1] Source: *Commerce and Navigation Reports.*

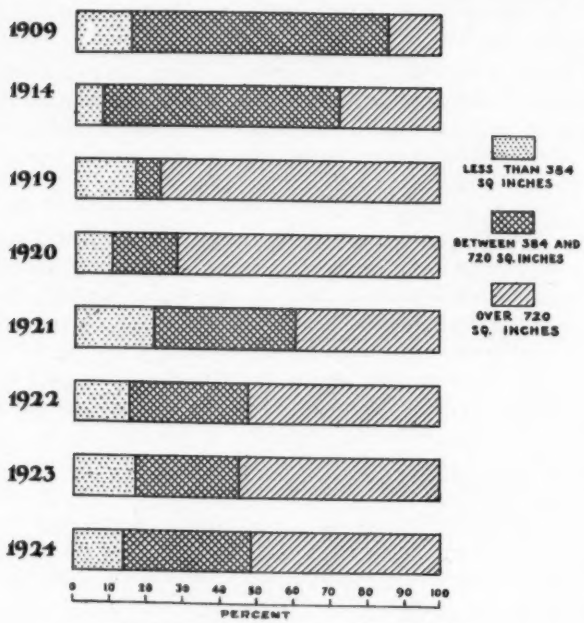


CHART I. POLISHED PLATE GLASS.
PERCENTAGE DISTRIBUTION OF IMPORTS ACCORDING TO SIZES—1909, 1914, and 1919-1924.
Data from Table 6.

present (1925) exports go chiefly to South America, Japan and Canada. Table 7 following gives export statistics.

Table 7. *United States: Domestic Exports of Polished Plate Glass*[1] 1909-1924

Year	Square feet	Value	Average value per square foot	Per cent of domestic production
1909	47,228	$17,834	$0.377	0.09
1914	74,867	35,767	.478	0.12
1919	7,318,099	4,221,360	.577	12.88
1921	2,243,559	1,334,517	.595	3.99
1922	[2]2,875,223	1,156,617	.403	3.75
1923	1,981,767	843,792	.425	2.17
1924	1,809,300	516,163	.285	1.97
1925 (6 mos.)	749,453	204,614	.273	1.32

[1] Source: *Commerce and Navigation Reports.*
[2] Includes wire glass.

V. Cost of Production.

1. *Summary.*

Costs of production were obtained from seven companies in the United States for the periods 1913,[1] 1922, and the first quarter of 1923. These companies manufacture practically the total output of plate glass in the United States.

German costs were obtained for 1913,[1] 1923, and for January, 1924 for approximately one-half of the total German production. Because of the fluctuation in the mark during 1923 only costs for 1913[1] and January, 1924, based on the gold mark, are shown in this report.

Belgian polished plate glass production costs were calculated for the year ending June 30, 1923, for three companies engaged exclusively in the manufacture of polished plate glass and in addition costs were secured from one company for the months of January and October, 1923.

[1] The costs for the year 1913 were obtained for comparative purposes only and are shown for the United States and Germany in Table 23 of the Appendix, page 32.

Cost data were obtained for one company in England and some pertinent statistical material was collected in France, but as both France and England export a comparatively small amount of plate glass to this country, data for these countries are not included in this report.

A summary of these costs for the more recent periods follows.

Table 8. *Comparative Weighted Average Costs of Production of Polished Plate Glass*
(1922, 1923 and 1924)

Item	United States: Year 1922	United States: First Quarter 1923	Belgian: Estimated costs for 3 companies for 1923 combined with actual cost for one company for October, 1923	German: January, 1924
	Costs per Square Foot			
Materials	$0.0529	$0.0496		[1]$0.0727
Labor	.1201	.1287		.0570
Fuel and Power	.0840	.0801		.1124
Supplies	.0674	.0643	Details not available	[1] —
Other Factory Expense	.0967	.1008		.0925
Administrative Expense	.0221	.0318		.0485
Total Manufacturing and Administrative	.4432	.4553		—
Selling Expense	.0057	.0050		[2] —
Total Manufacturing Administrative and Selling				
Excluding Interest	.4489	.4603	$0.2860	.3827
Including Interest	.4907	.4999	.3152	[3] —
Transportation, Insurance and landing charges to New York	.0317	.0317	.0410	.0460
Total cost, including delivery in New York—				
Excluding duty and interest	.4806	.4920	.3270	.4287
Excluding duty but including interest	.5224	.5316	.3562	[3] —

[1] German material costs include supplies.
[2] Selling expense included in administrative expense.
[3] Investment data for Germany not available.

2. *United States Costs.*

The specific items of cost, taken from monthly and yearly cost sheets, as submitted by each company, were verified by the Commission's agents by examination of the company's books and from these sources a summary of costs per square foot of polished plate glass was computed.

Tables 9 and 10, following, show for the United States the weighted average cost for the seven companies investigated and the range of costs shown by the figures from which the average has been calculated.

Table 9. *United States: Range of principal elements of cost per square foot of Polished Plate Glass,* 1922[1]

Items	Maximum cost	Minimum cost	Weighted average cost of 7 companies	Percentages represented by each element of the average unit cost
Direct material	$0.06313	$0.04523	$0.05291	11.79
Labor	.15840	.11006	.12013	26.76
Fuel and power	.12352	.05734	.08396	18.70
Supplies	.09039	.05690	.06740	15.01
Other factory expense	.11520	.05354	.09672	21.54
Administrative	.03847	.01112	.02212	4.93
Total manufacturing and administrative[2]	.48286	.40359	.44324	98.73
Selling	.00919	—	.00570	1.27
Total manufacturing administrative and selling[2]	.48574	.41230	.44894	100.00

[1] Total production, 77,346,253 square feet. Total production cost, $34,832,281. Total sales value of plate glass produced, $44,547,238.
[2] Not derived from preceding items in the maximum and minimum columns.

Table 10. *United States: Range of principal elements of cost[1] per square foot of Polished Plate Glass, First Quarter, 1923[2]*

Items	Maximum cost	Minimum cost	Weighted average cost of 7 companies	Percentages represented by each element of the average unit cost
Direct material	$0.06589	$0.04325	$0.04963	10.78
Labor	.17300	.11907	.12870	27.96
Fuel and power	.11667	.06473	.08006	17.38
Supplies	.10990	.05031	.06429	13.97
Other factory expense	.12374	.05288	.10080	21.89
Administrative	.04337	.01095	.03184	6.92
Total manufacturing and administrative[3]	.53273	.42279	.45532	98.91
Selling	.00801	.00075	.00500	1.09
Total manufacturing, administrative, and selling[3]	.53421	.42901	.46032	100.00

[1] Interest not included. Imputed interest at 6 per cent average for seven companies, $.0396 per square foot.
[2] Total production, 20,416,218 square feet. Total production cost, $9,400,788. Total sales value of plate glass produced, $13,882,518.
[3] Not derived from preceding items in the maximum and minimum columns.

A. *Elements of cost.*

(1) Direct materials.[1]—The raw materials of plate glass glass are sand (melting), soda, salt cake, lime, arsenic, charcoal, and in some plants common salt.

(2) Labor.—Direct and indirect labor costs are combined because of difficulties encountered in attempts to segregate the two. As workmen in this industry may be employed at several different jobs, it is impracticable to determine how much of their labor is direct and how much indirect.

(3) Fuel and Power.—In 1913 natural gas was both plentiful and cheap in Pennsylvania, and was the principal fuel used. Because of the depletion of this fuel during the past decade, coal was the principal fuel used during 1922-23.

(4) Supplies.—In the grinding and polishing processes of manufacturing polished plate glass there are used in large quantities many essential materials, such as plaster, grinding sand, emery, rouge, felt, cast iron runners or grinding bars and cloth. In America these materials are called supplies, while in Europe they are designated materials in the costs.

(5) Other Factory Expense.—Under this heading are all expenses not included in the first four divisions but which are a part of the factory cost, such as repairs and maintenance (exclusive of labor), of furnaces, lehrs, and other equipment; trucking and garage expenses (also exclusive of labor); workmen's liability insurance; fire insurance; rents actually paid on factory buildings necessary for operation; taxes, State and local; depreciation on buildings and equipment; and miscellaneous works expense.

(6) *Administrative expenses* include the following:

(a) Salaries of executives (President, Vice President, Secretary, Treasurer, General Manager, Assistant Manager).

(b) Salaries of superintendents, office clerks, stenographers, etc.

(c) Miscellaneous office expenses (supplies, telegrams, sundries).

(7) *Selling expenses* embrace:

(a) Salaries of sales executives (sales managers and assistants).

(b) Salaries of sales and shipping department clerks.

(c) Salaries of salesmen.

(d) Commission to selling agents.

(e) Advertising.

3. *Foreign Costs.*

a) *Belgium.*

The Belgian plate glass factories, with one exception, refused the Commission's agents access to their cost records. Therefore, in addition to the costs furnished by one company for January and for October, 1923, costs for other factories were estimated.

Six of the Belgian factories are combined under one selling organization (Union Commerciale des Glaceries Belge) and are compelled by law to publish balance sheets and profit and loss statements. These published statements are checked by auditors of the tax office of the Belgian Government and they appear to be reliable for this reason.

It was ascertained that of these six companies only three were engaged exclusively in the manufacture and sale of plate glass and therefore the other three companies were eliminated in computing costs. From the Profit and Loss Statements it was proved that the gross profit, before deduction of depreciation, for the three companies under consideration was 60,641,000 Belgian francs. The depreciation was shown for only two companies and was estimated at 10 per cent per annum on the value of immovable property for the third company. The total depreciation for the three companies was 3,131,000 francs.

As no published statistics of production were available for these three companies figures were estimated by multiplying the monthly production as of November, 1922 by five (i.e., assuming that it had been fairly constant since June 1922) and the December production by 7 (i.e., assuming that monthly production from December, 1922, to June, 1923, had been constant). This method is justified by the fact that the Association allocates to each member factory the maximum monthly production for specific periods. A change in this allocation was made in November-December, 1922, and therefore the period has been split as above indicated. The resulting production figure for the year ending June 30, 1923, was 19,789,284 square feet.

The average foreign selling price of glass exported by the Association to the United States during the same period was 8 francs or $0.50 per square foot (average rate of exchange 16.02). It is known that the plate glass shipped to the United States during 1922-23 brought higher prices than in any other market. It was admitted, moreover, that prices of plate glass for consumption in Belgium were lower than for export trade and that prices of that exported to England were between those prices received in Belgium and those quoted for export to the United States. A weighted average price based on the quantity of glass sold locally and that exported to the United States and to England gave an average figure of 7.2 francs per square foot.[1] This figure has been used in the computation, which is as follows:

[1] For comparison of material costs in United States, Belgium, and Germany, see Table 20, page 246.

[1] The Secretary of the Association reported an average price received during the period of 7.8 francs per sq. ft.

Table 11. *Computation of Belgian Costs Fiscal Year Ended June 30, 1923*

	Belgian Francs
Total Production or Sales (19,789,284 sq. ft.@7.2 francs per sq. ft.)	142,482,845
Gross Profit as per balance sheet 60,641,000	
Less Depreciation 3,131,000	
Profit on Sales	57,510,000
Cost of Operation	84,972,845
Cost per sq. ft.	4.3
Converted at average rate of exchange 1922-23 (16.02)	$0.270
Addition to cover overhead charges not included in cost of operations above	.026
Total cost per sq. ft.	$0.296

The item of $0.026, which has been added above, represents an allowance for overhead and general administrative expenses and was an estimated figure supplied by the Secretary of the Belgian Plate Glass Union. If this figure is combined with the average cost for the one company for which book costs were obtained, the weighted average cost for the four companies will be $0.286 per square foot.[1] This figure has been used in the tabulation.

(b) *German.*

Although costs were obtained in Germany for 1913,[2] 1923, and January, 1924, the 1923 costs have not been used because of the fluctuation in the exchange rate of the mark during that period.

Table 12 following shows the weighted average cost, together with the minimum and maximum costs of 4 German companies for which costs were obtained for January, 1924. Specific costs were taken from the cost sheets of these companies and verified by inspection of the companies' books.

VI. INTEREST ON INVESTMENT.

A summary of investment interest data for the plate glass companies from which production costs were obtained in the United States and Belgium is given in Tables 27 and 28.

Because of the difficulty in obtaining balance sheets on a gold mark basis for the four German plate glass companies and the unreliability of balance sheets stated in paper marks, no figures are shown for investment in German plate glass manufacture.

Table 12. *Germany: Maximum, Minimum, and Weighted Average Unit Costs of Polished Plate Glass Production,[1] January, 1924*

	JANUARY, 1924			
	Cost to establishment having		Weighted average cost	
	Maximum Cost, per sq. ft.	Minimum Cost, per sq. ft.	Unit, per sq. ft.	Per Cent of Total
Materials	$0.0784	$0.0529	$0.0727	19.00
Labor	.0641	.0334	.0570	14.89
Fuel and power	.1675	.0767	.1120	29.27
Factory overhead	.1058	.0845	.0925	24.17
Total factory cost[2]	.3589	.2957	.3342	87.33
Administrative and selling	.0687	.0298	.0485	12.67
I. Total cost of production[2]	.4276	.3255	.3827	100.00

[1] Not including interest.
[2] Not derived from preceding items in the maximum and minimum columns.

The net investment figures for the United States and Belgium respectively were computed, as shown above, by subtracting from the assets used in the production of glass the current and miscellaneous liabilities and reserves.

In the conversion of Belgian francs to dollars it was assumed that the fixed assets were acquired when the franc was at par; therefore, except for one company occupying a recently constructed plant, the value of fixed assets was converted at the par rate of exchange. Current costs, liabilities and reserves were converted at the average rate of exchange for the year ended June 30, 1923, except for one Belgian plate glass company, whose inventory values were shown on a gold basis.

The result of computing interest charges at 6 per cent for both the United States and Belgian plants is shown in Table 14.

VII. PRICES.

1. *United States.*

Tables 15 and 16 show the changes that have taken place

[1] Based on the prices as reported by the Secretary of the Association, the average cost for all companies would have been $0.310 per sq. ft.
[2] For 1913 costs see table 23, page 247.

Table 13. *United States and Belgium: Investment in Polished Plate Glass Production, 1923*

Assets	United States 1st Quarter, 1923 (7) Companies		Belgium Fiscal Year Ended June 30,1923. (4) Companies	
Current assets	$13,763,132		$4,031,704	
Inventories	4,703,533		1,350,244	
Fixed assets	38,878,742		9,790,653	
Deferred assets	2,071,702			
Other assets	2,376,963		696,653	
Total assets used in plate glass production		$61,794,070		$15,869,254
Less:				
Current liabilities	2,313,469		1,420,674	
Reserves	3,006,823		2,299,573	
Miscellaneous liabilities	2,670,181		537,713	
Total deductions		7,990,473		4,257,960
Net investment in polished plate glass production		$53,803,597		$11,611,294

Table 14. *United States and Belgium: Interest charges on investment in Polished Plate Glass Production, 1923*

Country	Investment	Interest at 6 per cent	Production Sq. ft.	Interest per square foot of production
United States— (Jan.-Dec., 1923)	$53,803,599	$3,228,235	81,664,872	$0.0395
Belgium— (July, 1922-June, 1923)	11,611,293	696,677	23,858,500	0.0292

[1] Compiled on the basis of production during the first quarter, 1923.

Table 15. *United States: Prices of Polished Plate Glass per square foot*

Area[1]	Oct. 1913	Jan. 1922	Oct. 1922	Jan. 1923	May 1923	Oct. 1923	1924	April 1925	Index Nos. of glass prices Apr., 1924 (1913=100)	Index Nos. of glass prices Apr., 1925 (1913=100)
					MANUFACTURER'S PRICES[2]					
Cut Sizes ¼" glazing quality										
1' to 2'8"	$0.19	$0.42	$0.49	$0.49	$0.55	$0.55	$0.55	$0.42	289	221
1' to 2'8"[3]	.19	.42	.66	.70	.85	.85	.85	.63	450	331
2'8" to 5'	.24	.52	.66	.70	.85	.85	.85	.63	354	263
5' to 10'	.32	.58	.70	.73	.88	.88	.88	.69	275	216
Cut Sizes ¼" mirror glazing quality 1' to 2'8"	$0.26	$0.48	$0.54	$0.64	$0.62	$0.62	$0.62	$0.48	238	185
1' to 2'8"[3]	.26	.48	.72	.77	.93	.93	.93	.78	358	300
2'8" to 5'	.30	.60	.72	.77	.93	.93	.93	.78	310	260
5' to 10'	.36	.66	.75	.81	.96	.96	.96	.90	267	250

[1] The sizes listed have the following surface areas: 1' to 2' 8" between 144 and 384 square inches; 2' 8" to 5' between 384 and 720 square inches; 5' to 10' between 720 and 1,440 square inches.
[2] Trade Journals report a 25% reduction in price of plate glass, effective August 1, 1925.
[3] Automobile sizes.

Table 16. *United States: Prices of Polished Plate Glass per square foot (Cont'd)*

Area	Oct. 1913	Jan. 1922	Oct. 1922	Jan. 1923	May 1923	Oct. 1923	1924	April 1925	Index Nos. of glass prices Apr., 1924 (1913=100)	Index Nos. of glass prices Apr., 1925 (1913=100)
Cut sizes ¼" 2nd silvering quality										
1' to 2'8"	$0.29	$0.53	$0.62	$0.62	$0.72	$0.72	$0.72	$0.53	248	183
1' to 2'8"[1]	.29	.53	.82	.87	1.03	1.03	1.03	.86	355	296
2' to 5'	.33	.69	.82	.87	1.03	1.03	1.03	.86	312	261
5' to 10'	.39	.80	.92	.95	1.10	1.10	1.10	.99	282	254
					JOBBER'S PRICES PER SQUARE FOOT					
Cut sizes ¼" glazing quality										
1' to 2' 8"	$0.25	$0.66	$0.63	$0.88	$1.15	$0.88	$0.63	$0.63	252	252
1' to 2' 8"[1]	.25	.97	1.12	1.12	1.12	.87	.87	.63	348	252
2' 8" to 5'	.32	.75	.76	1.06	1.40	1.06	.98	.76	306	240
5' to 10'	.47	.94	.99	1.24	1.64	1.24	.99	.89	211	189
Cut sizes ¼" selected qualities mirror and second silvering										
1' to 2' 8"	$0.29	$0.76	$0.72	$1.00	$1.32	$1.00	$ .72	$ .72	252	252
1' to 2' 8"[1]	.29	1.12	1.29	1.29	1.29	1.00	1.00	.72	348	252
2' 8" to 5'	.37	.86	.87	1.22	1.61	1.22	1.13	.87	306	240
5' to 10'	.54	1.08	1.14	1.43	1.89	1.43	1.14	1.02	211	189

[1] Automobile sizes.

since 1913 in both the manufacturer's and jobber's prices of polished plate glass.

From the price comparisons given it will be noted that the manufacturer's price per square foot, based on the 2 feet 8 inches to 5 feet bracket glazing quality cut sizes, advanced from 52 cents in January, 1922, to 85 cents in May, 1923, or 63.4 per cent, while the price of mirror glazing quality of the same size advanced during the same period, from 60 cents to 93 cents per square foot or 55 per cent. Prices of these two qualities and sizes in April, 1925, were 63 cents and 78 cents per square foot, respectively.

Jobbers' prices per square foot, based on the 2 feet 8 inches to 5 feet bracket glazing quality, advanced during this time from $0.75 to $1.40 or approximately 87 per cent, while on the mirror glazing quality of the same size there was an in-

2. Comparison of Foreign and Domestic Prices

Table 17. *United States, Belgium and Germany. Comparative prices of Polished Plate Glass,* 1923, 1924. *Glazing quality, ¼" cut sizes*

Area	United States[1]	Belgium[2]	Germany[3]
	sq. ft.	sq. ft.	sq. ft.
2' to 3'	$0.55	$0.226	$0.443
3' to 5'	.85	.290	.519
5' to 7'	.88	.329	.590
7' to 10'	.88	.349	.627
10' to 15'	.90	.361	.655
15' to 25'	.90	.368	.675
25' to 50'	1.00	.377	.703
50' to 75'	1.10	.407	.741
75' to 100'	1.10	.432	.773

[1] Unit prices at which polished plate glass was sold in the United States in 1923.
[2] Unit prices at which polished plate glass was sold in Belgium during 1922 and until October, 1923.
[3] Unit prices at which polished plate glass was sold in Germany in the fall of 1923 and spring of 1924.

Table 18. *United States Domestic and Belgian Export Prices of Polished Plate Glass and the United States Import Duties, April,* 1925.[4]

Brackets	United States[1]	Belgium[2]	Specific duty (Act of 1922)	Equivalent ad valorem on Belgian price
	Sq. ft.	Sq. ft.	Sq. ft.	Per cent
1'-2' 8" under 20" long	$0.34	$0.22	$0.125	56.8
1'-2' 8" over 20" long[3]	.42	.30	.125	41.7
2' 8"-5' (A)	.58	.43	.150	34.9
2' 8"-5' (B)	.63	.48	.150	31.2
5'-7'	.68	.51	.175	34.3
7'-10'	.70	.53	.175	33.0
10'-15'	.72	.55	.175	31.8
15'-25'	.79	.62	.175	28.2
25'-50'	.82	.65	.175	26.9
50'-75'	.84	.68	.175	25.7
75'-100'	.87	.71	.175	24.6
100'-120'	.97	.81	.175	21.6

[1] Wholesale prices f. o. b. factory. [2] Wholesale prices f. o. b. Antwerp for export to United States. [3] Sizes in this bracket 8" and 10" wide over 34" long charged at prices in 2' 8"—5'(B) bracket. (A) All sizes not included in (B). (B) Sizes 8" to 18" wide over 34" long and 20" to 26" wide over 20" long. [4] European prices reduced to meet U. S. reduction of 25 per cent effective August 1, 1925.

Table 19. *Polished plate glass. Price delivered in New York of Belgian and domestic glass. April, 1925*[1]

Brackets	Glazing for glazing: Stock sizes Belgian[2]	Glazing for glazing: Stock sizes Domestic[3]	Glazing for glazing: Cut sizes Belgian[2]	Glazing for glazing: Cut sizes Domestic[3]	Mirror glazing Belgian[2]	Mirror glazing Domestic[3]	Second Silvering Belgian[2]	Second Silvering Domestic[3]	First Silvering Belgian[2]	First Silvering Domestic[3]
1'—2' 8" under 20' long	$ 0.346	$ 0.332	$ 0.386	$ 0.372	$ 0.436	$ 0.422	$ 0.476	$ 0.462	$ 0.526	$ 0.512
2' 8"—5'[4]	.471	.462	.621	.612	.721	.712	.791	.782	.861	.852
2' 8"—5'[5]	....	.462	.671	.662	.821	.812	.901	.892	.991	.982
5' —7'	.626	.612	.726	.712	.926	.912	1.016	1.002	1.106	1.092
7' —10'	.676	.662	.746	.732	.976	.962	1.066	1.052	1.166	1.152
10' —15'	.706	.692	.766	.782	1.026	1.012	1.126	1.112	1.236	1.222
15' —25'	.736	.722	.836	.822	1.076	1.062	1.176	1.162	1.286	1.272
25' —50'	.766	.752	.866	.852	1.126	1.112	1.236	1.222	1.356	1.342
50' —75'	.796	.777	.896	.877	1.176	1.157	1.276	1.307	1.416	1.397
75' —100'	.826	.807	.926	.907	1.226	1.207	1.346	1.327	1.476	1.457
100' —120'	.876	.857	1.026	1.007	....	....	....	....	....	....

[1] Trade Journals report reduction in European prices to meet the domestic reduction of 25% effective Aug. 1, 1925.
[2] Includes price f. o. b. Antwerp packed plus duty at 12½, 15 and 17½ cents per sq. ft. plus freight and insurance at 1.6 cents, plus landing charges at 2½ cents per sq. ft.
[3] Includes price f. o. b. factory, plus freight to New York and packing at 3.2 cents and 3.7 cents per sq. ft.
[4] All sizes not included in (5).
[5] Sizes 8" to 18" over 34" long, and 20" to 26" wide over 20" long. Cut sizes 8" and 10" wide over 34" long in the bracket 1' to 2' 8" charged at the price of 2' 8" to 5'.

crease in price from $0.86 to $1.61, likewise approximately 87 per cent. Jobbers' prices have since been reduced, and were in April, 1925, on this size and for these two qualities

(*Continued on page 247*)

Table 20. *United States, Belgium, and Germany: Comparison costs of raw material and coal used in plate glass making*

Material		Year 1913 United States[1]	Year 1913 Germany[2]	1923 United States	1923 Belgium[2]	Jan. 1924 Germany[3]
Sand (melting)	per ton	$2.32	$1.46	$ 3.73	$0.95	$ 2.62
Soda	" "	15.27	20.92	28.09	20.94	35.90
Sulphate	" "	....	....	23.15	26.65	20.18
Salt Cake	" "	12.15	11.36	.....	.....	.....
Lime	" "	2.42	2.36	2.98	1.90	3.49
Salt	" "	3.10	.....	.....	.....	.....
Arsenic	" "	82.88	94.07	200.11	.....	367.08
Charcoal	" "	5.82	9.13	28.73	21.76	18.24
Coal (Producer)	" "	2.29	4.19	5.09	6.47	7.25
Coal (Steam)	" "	.....	.....	4.15	6.08	5.92

[1] Average for 7 companies.
[2] Average for 4 companies.
[3] Average for 4 companies.

Table 21.—United States, Belgium and Germany. Comparison of Wage Rates Paid in Plate Glass Industry
(Wages per Hour)

	Year 1913 United States[1]	Year 1913 Germany[2]	1923 United States[1]	1923 Belgium[2]	Jan. 1924 Germany[3]
Batch mixers...	$0.20	$0.095	$0.589	$0.147	$0.135
Furnacemen	.22	.105	.634	.178	.134
Layers	.21	.102	.625	.178	.128
Grinders	.20	.100	.625	.163	.126
Strippers	...	....	.625	.178	.190
Cutters	.19	.102	.550	.193	.127
Polishers	.18	.101	.602	.163	.133
Examiners	.19	.115	.550	.173	.125
Packers	.18	.084	.550	.153	.124
Pot makers	.20	.103	.680	.175	.129
Carpenters	.24	.099	.624	.147	.120
Bricklayers	.29	.106	.731	.175	.120
Mechanics	.24	.100	.645	.178	.120
Average Skilled	$0.210	$0.101	$0.610	$0.170	$0.127
Average Unskilled	.175	.076	.496	.046-.163	.098

[1] Average for 7 companies.
[2] Average for 4 companies.
[3] Average for 4 companies.

Table 22.—Ocean transportation, freight, marine insurance, and drayage charge on polished plate glass, 1923

Quotations from: U. S. Shipping Board; United American Lines; Black Diamond S. S. Co.; Holland American Lines

Shipping point to destination	Ocean transportation and freight rates	Marine insurance[1]	Landing charges at port of destination	Total
Hamburg, Germany, to New York	$0.018	$0.003	$0.025	$0.046
" " " Detroit	.042	.003	.025	.070
" " " Chicago	.050	.003	.025	.078
" " " San Francisco, all water	.012	.005	.025	.042
" " " " " " water and rail	.078	.0056	.025	.1086
Antwerp, Belgium, to New York	.013	.003	.025	.041
" " " Detroit	.040	.003	.025	.068
" " " Chicago	.047	.003	.025	.075
" " " San Francisco, all water	.012	.005	.025	.042
" " " " " " water and rail	.078	.0056	.025	.1086
			Packing chgs.	
Pittsburgh to New York	.0217	.....	.010	.0317
" " Detroit	.0200	.....	.010	.0320
" " Chicago	.0257	.....	.010	.0357
" " San Francisco, By rail	.125	.....	.010	.1350
" " " " " water	.070	.....	.010	.0800
New York to Detroit	.028	.....	.010	.0380
" " " San Francisco, rail	.146	.....	.010	.156
" " " " " water	.050	.....	.010	.060

Above rates are based on carload shipments.
[1] Marine Insurance to Atlantic ports is ⅛ per cent ad valorem; on average invoice price of foreign plate glass shipments of 50 cents per square foot = $0.003 per square foot. Marine Insurance to Pacific ports by all water route is 1 per cent ad valorem. Marine Insurance to Pacific ports by rail and water route is 1¼ per cent ad valorem.

mentioned, 76 cents and 87 cents per square foot respectively.

In table 19 is shown a comparison of foreign and domestic prices of polished plate glass delivered at New York, computed as follows. To the above foreign export prices are added transportation, marine and risk insurance charges, and landing charges in New York, amounting to $0.0410 per square foot, and the duty. To the above domestic prices have been added transportation from Pittsburgh, Pennsylvania, to New York and packing charges, amounting to $0.032 to $0.037 per square foot.

As a result of the world shortage of plate glass in the fall of 1922 and in the greater part of 1923, large consumers, unable to obtain sufficient quantities from domestic manufacturers, were compelled to buy in the open market at unusually high prices, often paying as high as $1.50 to $2.00 per square foot for unselected quality.

VIII. Price Comparison of Certain Elements of Cost.

Table 20 presents the prices paid for certain materials in Europe and the United States during designated periods.

Table 21 shows a comparison of wage rates in United States, Belgium and Germany.

IX. Tariff Problem.

In the tariff acts since that of 1894 the duty on plate glass and its price in the trade have been graduated according to the size of the sheet. Domestic manufacturers, however, have stated that costs of production per square foot are not affected by the size of the plate.[1] Since the smaller sizes have been consumed in increasing proportions during the last few years until they have come to be over 65 per cent of the total, manufacturers have protested against the existing duties graduated according to size.

The companies visited, both domestic and foreign, failed to show in their books separate costs of the various sizes of glass, and no other data were available from which such separate costs could be computed. Consequently, the foregoing production costs of polished plate glass are the average weighted costs per square foot and include plates of all sizes and qualities, no attempt having been made to allocate these costs to the various sizes which carry different selling prices, and upon which graduated duties are levied.

The trend of development in plate glass manufacturing has been toward the production of larger plates, for the reason that such plates, although more difficult to obtain free from defects, are quoted at proportionately higher prices and can be advantageously cut to the special sizes demanded by the trade. The cutting of the large plates so as to eliminate defects and to salvage unavoidable breakage, creates plates of all dimensions and results in a high percentage of small sizes.

While technical progress has made possible the production of larger plates, increase in consumption has been confined in the main to sizes under 5 square feet. While the bulk of the glass is originally produced in sizes above 10 square feet, most of the larger plates are subsequently cut to sizes below 10 square feet and even below 5 square feet.

Prior to the World War there was little demand for the small sizes (under 5 square feet) and even though their production was comparatively small (less then 10 per cent) stocks accumulated, necessitating the quotation of lower prices per square foot than on the larger plates. In recent years the great expansion of the automobile industry has reversed market conditions and created an unusually large demand for the small sizes so that manufacturers now cut approximately 50 per cent of the high priced large plates produced into sizes below 5 square feet. To offset potential loss from this cutting, the price of glass cut to automobile sizes (which are included in the smaller areas) has been increased from 9 to 60 per cent above the prices usually quoted for sizes having the same area but of different linear dimensions.

[1] See testimony of Mr. Wherrett before the House Committee on Ways and Means, 1921, page 622.

X. Appendix.

Table 23.—*United States and Germany: Comparison of the cost of production of cast polished plate glass,* 1913

Item.	United States[1] Average cost per sq. ft.	United States[1] Percent of Total	Germany[2] Average cost per sq. ft.	Germany[2] Percent of Total
Material	$0.07155	28.02	$0.0400	21.91
Labor	.08277	32.42	.0404	22.12
Fuel and power	.03802	14.89	.0432	23.66
Factory overhead[3]	.04832	18.93	.0426	23.33
Total factory cost	.24066	94.26	.1662	91.02
Administrative and selling	.01466	5.74	.0164	8.98
Total cost of sales	.25532	100.00	.1826	100.00

[1] Average of 7 companies.
[2] Average of 3 companies.
[3] Factory overhead includes heat and light, breakage loss, warerooms and miscellaneous supplies, depreciation, taxes and insurance.

Part II.—Mirror Plates

I. Rates of Duty.

	Rates of Duty, Tariff Act of 1922[1]	1913	1909
Cast, polished, plate glass, silvered, cylinder and crown glass, silvered, and looking glass plates, exceeding in size 144 square inches	Par. 223	Par. 89	Par. 103
	Per sq. ft.	Per sq. ft.	Per sq. ft.
Not exceeding 384 sq. inches	13½c	7c	11c
Above 384 sq. inches and not exceeding 720 sq. inches	16c	9c	13c
Above 720 sq. inches	21c	13c	25c

[1] Minimum of 35 per centum ad valorem.
NOTE—This investigation does not cover cast, polished, plate glass, silvered, cylinder and crown glass, silvered and looking glass plates, under 144 square inches in size, dutiable under Par. 230 at 50 per centum ad valorem.

II. Production.

1. *Raw Materials.*

Mirrors are manufactured from three different qualities of polished plate glass, first and second silvering and mirror glazing. The dependency of the mirror manufacturer upon the plate glass manufacturer for the supply of this principal raw material is indicated by the fact that over 90 per cent of the mirrors produced in this country are made from polished plate glass. Cylinder glass has been used to some extent, although it can be used only in the production of small mirrors of an inferior grade on account of its fragility and the presence of surface defects which silvering tends to exaggerate.

Other materials commonly used in the production of mirrors are: silver nitrate, ammonia, Rochelle salt, tartaric acid, sugar, lacquer and paint.

2. *Distribution, Organization and Output.*

a. *United States.* There are scattered throughout the United States many mirror-producing establishments most of which are small concerns operated in connection with some other business, usually the jobbing of plate glass. Some mirrors are produced by the plate glass manufacturers, but the greater number come from a comparatively few large mirror factories located in close proximity to the furniture manufacturing centers. The following table shows the domestic output of mirror plates.

Table 24. United States, Quantity and Value of Mirror plate production.[1]

Year	Square feet	Value	Unit Value
1913	17,745,000	$10,302,175	$0.581
1916	22,619,850	14,989,210	.663
1919	15,889,275	19,083,491	1.201
1920	17,524,402	25,806,562	1.473
1921	11,633,850	13,104,422	1.126
1922	18,084,375	21,279,280	1.177
1923	.....	28,694,562[2]	

[1] Source: Secretary of Mirror Manufacturers' Association.
[2] Census of Manufactures, 1923.

The building expansion over the United States during 1922 and 1923 with the subsequent demand for furniture and mirror plates was greater than in many years past and although the mirror manufacturers produced more mirrors in 1923 than ever before, they were unable to supply the increased demand. This unusual situation was caused by their inability to obtain selected plate glass in sufficient quantities.

b. *Foreign.* With the exception of the output of a few small independent plants, which silver glass for the local furniture and sanitary-ware manufacturers, most of the mirrors produced in Europe have for many years been made in the plate and cylinder glass factories.

However, owing to the abnormal demand for unsilvered plate glass in 1923 and 1924 and the attractive prices offered, plate glass manufacturers of Europe, particularly those of Belgium and Germany, have found it more profitable to sell polished plate glass unsilvered and have therefore curtailed their production of mirrors; the output in these countries of late years consequently has been confined to small independent mirror companies who have been able to supply only the local consumers.

III. UNITED STATES IMPORTS.

Imports of mirror plates in recent years are shown in the following table:

Table 25. United States: Imports for consumption of mirror plates. 1910-1924.

Year	Square feet	Value	Unit Value
Fiscal			
1910	6,374	$ 1,946	$0.31
1911	10,252	2,865	.28
1912	1,381	403	.29
1913	832	527	.63
1914	18,049	4,861	.27
1915	2,592	994	.38
1916	2,547	515	.20
1917[1]	.....	.....	....
1918	179	82	.46
Calendar			
1918	23	23	1.00
1919	96	175	1.82
1920	35,138	27,743	.79
1921	42,686	28,853	.68
1922[2]	78,678	38,566	.49
Fiscal			
1922[3]	14,622	8,363	.57
1923	164,714	65,149	.39
1924	60,602	31,767	.52
1925 (7 mos.)	25,432	12,387	.49

[1] Imports for 1917 were negligible.
[2] Nine months, 1922.
[3] Sept. 22 to Dec. 31, 1922.

Over 80 per cent of the imports of mirrors have come from Germany and have consisted largely of looking-glass plates, an inferior grade of mirror made from cylinder glass.

Since 1910 imports have represented a very small percentage (less than 1 per cent) of domestic consumption. In 1923 more mirrors were imported than in any other year since 1910, yet the total amount represented only .65 per cent of our consumption for that year.

IV. COST OF PRODUCTION.

1. *Summary.*

Cost data were obtained by the Commission's agents from 6 companies in the United States for 1922 and the first quarter of 1923, and from two companies in Europe (one in Belgium and one in Germany) for 1923. Because of the small number of companies included in the foreign investigation, no details of cost are shown other than those included in Table 26.

Table 26. United States, Belgium, and Germany. Summary of Domestic and Foreign Costs of Production of Mirrors for Recent Periods.

Item	Average Cost of 6 companies in the United States		Average of one Belgian and one German Company.[1]
	1922	1st quar. 1923	Year 1923
	Costs per square foot		
Materials	$0.5829	$0.7429	$0.411
Labor	.0792	.0815	.029
Overhead	.0859	.0669	.053
Total	.7480	.8913	.493
Polished glass plate	.5585	.7169	.386
Silvering and beveling	.1895	.1744	.107
Total	.7480	.8913	.493

[1] Belgian francs converted at $0.0458; German marks at $0.238.

2. *United States.*

The mirror companies from which production costs were obtained are located in western New York, Michigan, and Indiana, near furniture-producing centers and are representative of both the large and small mirror establishments of this country. Costs for United States are summarized in the preceding table.

3. *Foreign.*

Heavy demands in recent years made upon plate glass manufacturers of both Belgium and Germany for unsilvered glass created a scarcity of suitable quality plate glass for silvering and led to a decided curtailment in production of mirrors in those countries.

Many companies that had formerly produced mirrors as well as plate glass discontinued their production entirely, while the independent mirror companies were limited to a production hardly sufficient to meet the local requirements.

The Commission secured costs of production for only 2 companies in Europe, one in Belgium and one in Germany. These costs are combined and summarized in Table 26 above.

Table 27. Discounts in prices of mirrors for specified periods.[1]

Grade	Average 1913 Per cent	July 1922 Per cent	October 1922 Per cent	January 1923 Per cent	March 1923 Per cent	September 1923 Per cent	April 1924 Per cent	April 1925 Per cent
1st quality	90&10	90	87.7	87.7	85.8	88	88	90
2nd "	90&20	93	90	90	89	90	90	90&10
Commercial	90,30&5	93.6	92	91	90	91	92	90&25

[1] 1913—Discounts are based on official price list of October, 1909.
1922—1923-1924 Discounts are based on official price list of June, 1918.

Table 28. Mirrors. Wholesale domestic prices (less discounts) of mirrors for specified periods.

Size and Grade	Average 1913 Per sq. ft.	July 1922 Per sq. ft.	Oct. 1922 Per sq. ft.	Mar. 1923 Per sq. ft.	Increase Mar. 1923 over July 1922 Per cent	Sept. 1923 Per sq. ft.	April 1924 Per sq. ft.	April 1925 Per sq. ft.	Increase Apr. 25 over Mar. 23 Per cent	Increase Apr. 25 over 1913 Per cent
8" x 22"										
1st quality	$0.52	$1.43	$1.76	$2.03	42	$1.72	$1.72	$1.27	37.4	144
2nd "	.466	1.00	1.43	1.57	57	1.42	1.43	1.14	27.4	144
Commercial quality ...	.387	.92	1.15	1.43	55	1.29	1.15	.85	40.6	119
24" x 30"										
1st quality	.606	1.59	1.96	2.26	42	1.91	1.91	1.59	29.6	162
2nd "	.539	1.11	1.59	1.75	57	1.59	1.59	1.43	18.3	165
Commercial quality ...	.448	1.02	1.27	1.59	56	1.43	1.27	1.19	25.2	165
30" x 40"										
1st quality	.813	1.72	2.12	2.45	42	2.07	2.07	1.22	29.8	111
2nd "	.740	1.21	1.72	1.90	57	1.72	1.72	1.55	18.4	109
Commercial quality ...	.599	1.11	1.38	1.72	55	1.55	1.38	1.29	25.0	116

V. PRICES.

1. *Domestic Prices.*

Mirror manufacturers sell mirrors to large consumers such as the furniture manufacturers, at discounts differing according to the quality. The discounts are based on an official list price published by the Mirror Association.

The average discounts quoted since 1913 for the three principal qualities by ten of the leading mirror manufacturers are shown in Table 27.

Wholesale prices of mirrors with deductions of the above discounts, of sizes 8 inches by 22 inches, 24 inches by 30 inches, and 30 inches by 40 inches (sizes most commonly used and referred to in one of the applications) since 1913 were as shown in Table 28.

It will be observed from the foregoing figures that the average price of commercial quality mirrors of the medium size (24 inches by 30 inches) advanced from $1.02 per square foot in July, 1922, to $1.59 per square foot in March, 1923, or 56 per cent. In April, 1925, the price of this size and quality was $1.19 per square foot.

In certain instances, owing to variations in discounts, the advances in mirror prices between the above dates were found to be from 70 to 75 per cent. These are more or less exceptional, however, and are not representative of the general price advances throughout the mirror industry. In general mirror prices have tended to advance with the advances in the manufacturers' prices of polished plate glass.

During the same period the manufacturer's price on glazing quality plate glass (medium size) advanced from 52 cents to 85 cents per square foot, or 63 per cent, and on mirror quality plate glass from 60 cents to 93 cents, or 55 per cent.

Jobbers' price on glazing quality plate glass (medium size) during the same period advanced from $0.75 to $1.40 per square foot, or 86.7 per cent, and on mirror quality from $0.86 to $1.61 per square foot, or 87.2 per cent.

The increased demand for mirrors during the latter part of 1922 resulted in a rising price of mirrors with the result that there was a greater demand for selected quality plate for use in silvering than the manufacturers were able to supply. These mirror manufacturers went into the open market and bought selected glass at premium prices. The resulting high price of mirrors caused consumers to restrict buying and in order to stimulate business and meet prices quoted by overstocked jobbers, mirror manufacturers reduced the price of commercial quality mirrors.

Successful Treatment for Hydrofluoric Acid Burns

When acid of any strength gets on the skin, get water on it at once. Keep the part submerged in the coldest water available, preferably ice water, or continuously swab it with plenty of water until it stops burning, or until white burned portion turns pink. This is better than anything else you can do.

If there has been delay in washing, then the washing should be more prolonged. Sometimes several hours of steady washing are necessary, but it is a sure cure and the best cure.

Now wash finally with weak soda bicarbonate solution and then mercury bichloride solution containing one part of mercury bichloride to three thousand parts of water. Bandage, using an absorbent cotton compress moistened with bichloride solution. This bandage should be kept moist by occasionally wetting with water from the outside. If treatment has been delayed and pus forms after a day or two, get a doctor to lance the painful and swollen spots and bandage again with absorbent cotton moistened with bichloride solution.

According to Howard B. Bishop, president of John C. Wiarda & Company, chemical manufacturers, 265 Green street, Brooklyn, N. Y., treatment according to the above directions has proved successful in plants manufacturing hydrofluoric acid. Mr. Bishop has prepared hangers on which the directions are printed and will be glad to send one to any person interested on request.

Notes on the Purity of Cadmium Sulphide

By H. V. Huber

The manufacturer of ruby glass, in choosing the cadmium sulphide to be used, is frequently guided by physical properties that are unimportant or misleading. As an example, the color of the product as received will often change on calcining, and since the pigment is highly heated in the glass batch, it is the latter color that is more important. In general, the manufacturer should use a cadmium sulphide of reasonably high purity and free from diluting or harmful foreign matter. Such a product is termed "technically pure" by Lunge in his standard work on technical analysis, and six tests are given which it must pass. These are outlined below, together with the common impurities they detect.

1—Clear solution in hydrochloric acid diluted with an equal amount of water. Indicates absence of free sulphur, barium sulphate, lead chromate and heavy metals.
2—Complete insolubility in water. Indicates proper washing.
3—No precipitate on treatment with acetic acid and addition of an excess of alkali. Indicates absence of substrata.
4—Heated in a hard glass test-tube over the Bunsen burner:
(a) The product turns bright red on heating and then cools to a clear yellow. Indicates absence of basic cadmium compounds.
(b) There is little moisture and no sulphur or metallic mirror deposited on the cooler parts of the tube. The mirror indicates the presence of oxalates or carbonates of cadmium.
5—No yellow color on treatment with ammonia followed by hydrochloric acid. Indicates absence of arsenic compounds.

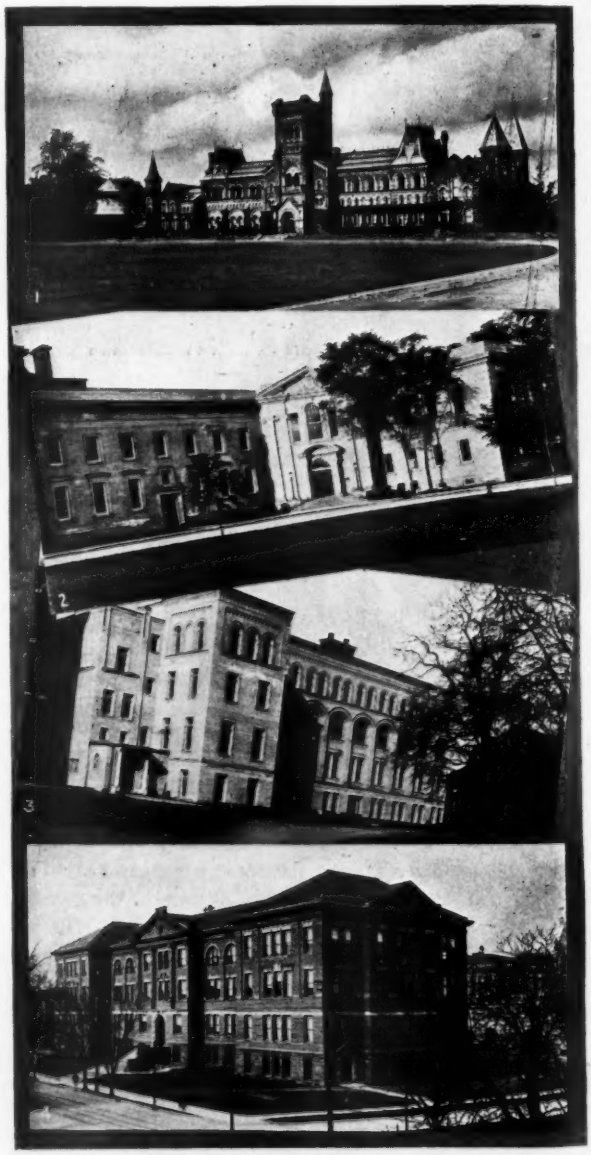
Samples from various manufacturers were subjected to these tests with the following results:

Sample A—Deep orange in color, sometimes called red cadmium sulphide.
Test 1. Cloudy solution. Free sulphur.
Test 4a. Dark brown residue on cooling.
Test 4b. Moisture and free sulphur shown.
Result—A basic cadmium sulphide.
Sample B—Orange-yellow in color.
Passed all tests.
Result—A technically pure product.
Sample C—Yellow in color.
Test 1. Large white residue. Barium sulphate.
Result—A diluted product.
Sample D—Yellow in color.
Test 3. Large precipitate.
Test 4a. Dirty residue.
Test 4b. Large mirror. Oxalate substratum.
Result—A substratum product.
Sample E—Yellow in color.
Test 3. Effervescence and large precipitate.
Test 4a. Brown residue.
Test 4b. Small mirror. Carbonate substratum.
Result—A substratum product.

It will be seen that only one of the samples can be considered a "technically pure cadmium sulphide". This product showed a slight white film in test 4b, but this is allowable as it is due to a small amount (not more than 2%) of soluble cadmium salt, that is carried down on precipitation and mechanically enclosed or absorbed. It is always found and is harmless. Sample A represents the type of cadmium sulphide used by some of the large manufacturers of ruby glass. It was found on analysis to contain only 82% of CdS, while Sample B is nearly 98%. It will be seen that depth of color is not an indication of purity. The color of carefully prepared cadmium sulphide is always orange yellow to yellowish orange.

University of Toronto Buildings

Some of the buildings constituting the home of the University of Toronto, at Toronto, Canada, are shown above. It is here that, as recently announced, a new course in ceramics has been established under the supervision of Robert J. Montgomery, formerly with the Bausch & Lomb Optical Company. The course has been added to the university activities at the request of the Canadian Clay Productions Association, who called attention to the need of men familiar with local clays and manufacturing conditions. The value of clay products in Canada is over $11,000,000 per year, including not only heavy clay products such as brick, floor and wall tile, pottery, sanitary ware, rough tile, stoneware, drain tile, sewer pipe, etc., but porcelain, glass, refractories, enamel ware, abrasives and many others. The work this year will cover the origin, properties and classification of clays and other ceramic materials; the preparing, shaping, drying and burning of clays; and the compounding of ceramic bodies and glazes. The lectures will be supplemented by practical laboratory work.



1. UNIVERSITY COLLEGE.
2. MINING BUILDING.
3. ENGINEERING BUILDING (CERAMICS).
4. SIMCOE HALL.

The Reduction Process*

Transparent and Colored Etching on Glass

By Dr. Mauder†

Glasses with a beautiful metallic lustre, transparent or opaque, are made by the reduction process. For the manufacture of such glasses a special oven is necessary, made from strong sheet iron. The chimney is arranged in such a way that it can be completely closed with a damper so that the gases are retained.

For the matt etching of glasses to be colored, etching baths are required.

Preparation of the Etchings Baths

For transparent etching, dilute hydrofluoric acid is used. The proportions depend on the strength of the acid and also on the amount of use the bath has had. The proportion of 1:10 may serve as a standard. If the bath is too weak, some hydrofluoric acid should be added; if too strong it should be diluted with water.

MATT ETCHING BATH. A good matt etching bath is made as follows: Dissolve 100 parts of potassium fluoride in 100 parts of water. The acid fluoride salt is dissolved in water until saturation. To increase the strength, one part of hydrochloric acid should be added.

Both baths should have a temperature of 20° C. and should be kept in lead containers.

Preliminary Treatment

Every piece of glassware is thoroughly cleaned before putting it in the bath. The cleansing must be done by washing with soap and a brush, and dipping in a soda solution, followed by a thorough rinsing with running water. Care must be taken not to touch the outside of the glass with the fingers, after this cleaning process. All such places become visible after the matt etching as finger prints, caused by the fat always present in the human skin.

In the transparent etching bath the glass is dipped for a period of 5 to 10 minutes according to the strength of the bath. This bath has the purpose to remove any remaining impurities and uneven spots on the surface. For the dipping of the glass objects rubber gloves are used, since the acids have a corrosive action and burn the skin. Although this bath is not strong, it is advisable to be careful. A holder may be used with room for a number of glasses, in order to dip them in the bath at one time.

From this bath the glass is transferred directly to the matt etching bath. The glasses are dipped in such a way that they are filled with the liquid and sink to the bottom. If the matt etching is to appear only on the outside the glass should only be allowed to float in the bath. The hollow part of the glass is filled with water until the etching liquid reaches the edge of the glass.

To obtain a silky matt it is sufficient to etch the glass 7 to 10 minutes. Longer exposure to the etching bath does no harm, especially if the bath has stood a long time and has been used a good deal. It is absolutely necessary to make preliminary tests. If the glasses are etched too strongly they are transferred again to the clear etching bath for a longer or shorter time, according to the density of the matt. This bath diminishes the depth of the matt etching. Immediately after taking the glass from the etching bath, it is rinsed with running water to remove all traces of acid. Salts can be removed by dipping the glass in a soda solution, and by cleaning it with a brush and soap. If in this way a good matt etching is obtained, the next step can be taken.

Covering the Glass

First, the required mixtures are prepared separately, namely, the yellow etch and red etch, as follows:

A. PREPARATION OF YELLOW ETCH. The following is the method used at the Trade School of Zwiesel: Silver-nitrate is dissolved in a little water. The yellow ochre to be used must first be burned in a muffle. For every 100 grams of ochre, 15 grams of silver nitrate is used. This proportion is sufficient for the average kind of glassware. The silver solution is thoroughly mixed with the ochre. Only so much water must be used to dissolve the silver nitrate that the mixture with the prescribed amount of ochre gets the right consistency. To make the mixture even more homogeneous, dilute hydrochloric acid is added until no further white precipitate is formed. In this way a good grade of yellow etch is obtained that will give a perfect yellow. The mass can be used at once. If the glass is well suited to yellow etching the residue, washed from the glassware after firing can again be used without addition of new silver nitrate. This is only possible for the better class of potash glasses, not for glasses high in lime.

B. PREPARATION OF RED ETCH. To 100 grams of finely pulverized yellow ochre (which must be previously burned) are added 200 grams of crystallized copper sulphate in water solution. The mass is mixed in a porcelain dish and evaporated to dryness—by heating with frequent stirring. It is important to obtain a thorough mixture. Insufficiently mixed red etch always gives bad spots that influence the color more or less. Some gum arabic or sugar solution is added to the quantity of mixture that is sufficient for the work to be done. If gum arabic is used, only the pure material should be taken, and no substitute. Otherwise the result is doubtful. A container is filled with water to which some sugar or gum arabic is added. This solution serves to dilute the mixture.

The application of the colored etching materials is a matter of skill. Some training is necessary in order to obtain the desired result. Many a failure that is later blamed to a variety of causes is due to faulty application. It must be tried out thoroughly, and for this reason the whole procedure will be described in detail. Much useless work is done when the exact method is not followed, and no description is of any use if certain rules are not followed carefully. Painstaking care is necessary from the start to obtain good colors.

* *Keramische Rundschau*, 33, 527-530. Translated for THE GLASS INDUSTRY.
† Professor; Director of the Glass Trade School in Zwiesel, Bavaria.
[For a description of this Institution see THIS JOURNAL, 4; 9 (Jan., 1923)]

Application of the Yellow Etch

If bluish, greenish, gold or yellow colors are desired the yellow etching mixture is used exclusively. The application is done as follows: First the glass is evenly covered with the dilute mixture. Then in the liquid layer an application of thicker mixture is painted in the form of bands, waves or patches in such a way that a certain regularity is obtained. However, no definite pattern should be followed since the whole technique should strive to appear accidental. Streaks of the brush should be avoided. The different patches should be made to run together. To obtain this and to prevent traces of definite patterns the glass after being finished should be shaken so that the designs run together. This is possible if care is taken to keep the layers wet. If pure water is taken the application dries too rapidly and it is quite impossible to mix the different applications by shaking. For this reason a substance that retards the drying, such as gum arabic or sugar is necessary.

Another procedure is as follows: The whole glass is painted with an even, semi-liquid mass and the glass is shaken. The layer thus becomes like fish scales and gives a good even covering. If the mixture has been too liquid it runs off the glass, if too viscous it cannot be distributed sufficiently and is also useless. Some trouble can occur during the drying process. If the coloring mass does not have the proper consistency a great change may occur during drying. The color often runs together considerably, leaving uncovered glass. Sometimes the object can be used but in severe cases it is best to remove the covering and replace it by a new one. This trouble can be avoided if the glass is kept moving and is shaken somewhat until it has reached a certain degree of dryness.

If colors are desired of a more reddish tone a little of the red etch is added to the yellow etch and the mixture is used for a second application. The mixing is best done on a plate of glass. The method of application is the same as before.

As a third method the work can be done entirely with red etch. In this process the red colors are predominant but violet, bluish and green colors of all kinds can also be obtained. If this mixture is applied to glass very smoothly a red etch is obtained. However, not every kind of glass is suitable. Glasses high in lime should not be selected for red etching, Bohemian crystal is better. Good potash glasses are also useful, glasses containing some lead are still better suited. The latter give pure colors.

DRYING. The drying has already been described. For further drying, 3 to 4 hours are sufficient, if not too much gum arabic or sugar has been added. It is best to allow the glassware to stand over night and to do the burning the following morning.

REDUCTION MUFFLE. A comparatively small experimental muffle should be used, about 60 to 70 cm. deep, 40 cm. high and 40 cm. wide. The muffle should be made of strong sheet iron with a double bottom to avoid burning through. The cover is also made of sheet iron and has in its upper part an observation opening of about 2 cm. diameter. This cover must be well fitting and should be so arranged that it can be pressed down closely by means of an iron bar. To prevent loss of heat an asbestos board can be put on the inside of the sheet. For this purpose a ridge is made in which the asbestos sheet can be fitted. In the chimney a movable damper should be placed.

BURNING. The first burning, the oxidation, is very simple. The bottom of the muffle is covered with asbestos board, also the sides and the back to prevent deformation by the sharp heat. Supports and asbestos board are kept in readiness in case a second layer is to be made, when several glasses are burned at the same time. For the first experiments one-half of the glassware to be burned is placed below, the other above. To test the temperature some Seger cones are introduced, Nos. 022 and 021 both at the left and right sides. They can also be placed at the back. During the firing no coal should be put in the muffle, which must be entirely clean. When the glasses are introduced the cover is put on, but is not made air-tight with clay. The firing must be done gradually. When the oven is warm the firing can be done quite strongly. When an intense red heat is obtained care must be taken that not too much fuel is added. When Seger cone No. 021 begins to bend over all the fuel is removed and the first firing is ended. After two or three hours the lid can be lifted somewhat and after two more hours the glassware can be removed. The glasses now should show already a color but usually only yellowish and greenish tones,[1] that however must yet become more transparent. If among the glasses there are some showing opacity the chances of complete success are not great. It is best to etch them again and cover them anew.

Reduction

The second firing, the reduction can then be carried out. Before the glasses are placed in the muffle a number of pieces of charcoal are laid around the walls. Between them are put 8 to 10 pieces of lignite, about the size of a nut. Between the pieces of glassware a number of pieces of lignite may be placed. The Seger cones are placed as described before. The cover is then closed tight and the edges are covered with clay so that the gases developed in the interior cannot escape. The observation hole is closed with a well-fitting wooden stopper which should be easily removable at all times.

The firing is done as previously described. When red heat is obtained the damper in the chimney should be closed so that the smoke and heat cannot escape. At this time the muffle should show a red heat so that the temperature can be raised somewhat. The muffle is kept in this condition for about 10 minutes. Through the closing of the draft, the coals inside the furnace form gas as in a gas retort. If everything has been carried out carefully the smell of gas is soon observed. Whether gas in sufficient quantity is being formed can be tested at the observation hole. A burning match held at the hole will ignite the escaping gas, which will burn with a bluish green flame. After about ten minutes the fire should be removed and the muffle is allowed to cool, while the damper is kept closed. The beauty of the colors depends mainly on the second firing. Descriptions of the process help to overcome the initial major difficulties, but

[1] Silver gives yellowish, copper greenish colors.

everybody has to pay for his experience before results become a certainty.

If less lignite is used, more bluish and lighter tones are generally obtained. Increase of the amount of lignite gives deeper colors. Naturally differences are caused when more or less gas is formed. For the application with copper mixture, more lignite gas is required. The temperature also has a great influence on the coloration. If too low, the colors will develop less. The temperature should rise to the softening point of Seger cone No. 021. Since this is about the softening point of glass the heat should be kept at this point only for a short time. It should be remarked here that a new muffle that has never before been used for this purpose does not work right. The results do not become really satisfactory until the muffle has been in use for some time. The cause of this may be that the muffle must first become saturated with coal gas, and does not really become fit for use until that time.

The cooling after this fire should be slow, at least six to seven hours. The glasses are then removed. If the gas generation has been too strong and if the coal has given off soot (which will only happen when much lignite is used), a final firing is necessary. If the directions have been followed carefully, the reduction has been made correctly during the second firing and the colors will have appeared. Usually some very good glasses are found, some fair ones, and some that are unsatisfactory. This is caused by the fact that the gases do not act regularly, and that the heat has been different. It can also be caused by differences in the application of the color or by differences in the matt etching. Oftentimes opacity occurs. This may be caused by too much matt etching, or by an excessive layer of coloring paste. Such pieces are etched clean in the transparent etching bath and treated over again. Very thin glass generally gives good colors and looks well, but it has the disadvantage of being easily deformed. Heavy glassware should not be used as the coloring process is not favorable to this kind of glass. Glasses shaped like a dish should be avoided. The action on the glass surface located on the inside is not always very favorable. Often silvery yellow tones are developed, especially if the inside has been etched. These colors are not formed when the glass has not been etched previously, in which case the same colors appear inside and outside. The best color effect is obtained in reflected light and therefore glass shapes that become more narrow towards the top are to be preferred.

The feature especially to be aimed at is the preservation of the glassy characteristics. Especially to matt etched glasses, the reduction process is apt to give a stone-like appearance to glass. For this reason it is advisable to give the glasses only a light matt or to do without it entirely. The reduction process has certain difficulties for the inexperienced operator even with unetched glass. Very harsh colors may appear that are anything but beautiful. Through proper manipulation, however, this can be avoided.

A modification of this process which yields a product with a glassy appearance is the treatment of the clear glass (not etched) on the inside. This can only be done with glasses that are wide enough to allow application of the mixture on the inside. For the beginner it is best to start with a mixture according to definite prescription and to make his experiments slowly. In this way it is easier to obtain success that is an incentive to further experiments.

It must be remarked that this process is as yet not suitable to mass production. For this purpose it is as yet insufficiently investigated.

Courtesy of The Metropolitan Museum of Art

ETCHED GLASS, DUTCH-AMERICAN, 18TH CENTURY

A Classified List of the United States Patents on Glass

By T. E. Kirch*

(Concluded from October issue)

53. Heating Apparatus

15,018	15,389	98,963	265,967	290,844	499,624	578,441
673,615	683,617	812,065	823,757	839,220	905,489	916,959
995,267	1,014,247	1,025,680	1,032,923	1,054,001	1,097,932	1,101,057
1,117,565	1,122,475	1,122,476	1,124,823	1,136,832	1,143,296	1,144,234
1,151,942	1,157,246	1,157,980	1,165,960	1,165,963	1,178,543	1,180,876
1,183,696	1,183,697	1,207,659	1,215,571	1,226,022	1,242,055	1,248,483
1,249,868	1,251,561	1,255,983	1,285,450	1,302,149	1,309,199	1,312,305
1,318,050	1,333,903	1,338,109	1,371,084	1,458,030	1,462,993	1,484,101

54. Tank-Furnaces

Re.7,219	Re.7,764	103,208	129,657	141,666	155,887	228,296
231,123	240,638	254,572	261,054	263,059	268,213	279,254
281,697	294,122	304,955	312,422	328,173	330,050	427,654
520,835	555,964	578,563	612,233	617,748	781,827	792,705
796,410	795,971	808,804	811,223	967,967	1,034,824	1,145,815
1,199,044	1,215,507	1,237,282	1,237,283	1,250,893	1,322,767	1,390,614
1,410,782	1,421,210	1,421,211	1,422,858	1,432,706	1,443,767	1,486,992
1,500,651	1,502,068	1,514,307				

55. Delivering

Re.13,929	Re.14,745	212,168	214,572	305,376	512,321	588,318
624,290	624,291	653,848	691,371	696,738	723,982	756,894
757,412	770,964	774,690	775,740	794,734	796,513	805,067
808,810	828,838	828,839	832,569	832,570	834,012	840,245
841,112	850,233	851,438	852,196	854,511	858,085	859,084
861,401	868,034	870,250	883,779	892,013	948,518	950,092
966,753	984,974	1,002,375	1,020,409	1,021,904	1,027,282	1,027,033
1,065,682	1,080,742	1,090,101	1,100,776	1,103,066	1,118,204	1,121,608
1,138,110	1,138,111	1,143,112	1,146,694	1,150,030	1,151,393	1,166,576
1,170,575	1,174,173	1,178,678	1,179,868	1,193,788	1,200,195	1,207,363
1,214,089	1,215,507	1,218,492	1,234,934	1,236,496	1,241,790	1,246,764
1,249,491	1,260,428	1,262,375	1,264,328	1,265,827	1,266,011	1,269,597
1,274,625	1,275,178	1,277,254	1,277,255	1,279,569	1,281,083	1,288,227
1,300,180	1,307,150	1,307,527	1,310,225	1,311,474	1,315,562	1,317,827
1,322,318	1,323,450	1,323,507	1,329,851	1,331,467	1,331,511	1,332,405
1,338,214	1,343,183	1,349,551	1,350,448	1,350,464	1,353,115	1,353,276
1,353,907	1,353,953	1,362,785	1,378,460	1,382,993	1,390,448	1,391,957
1,394,920	1,394,677	1,395,591	1,399,116	1,401,921	1,401,922	1,405,936
1,413,757	1,413,788	1,414,561	1,423,220	1,424,184	1,428,994	1,439,198
1,439,369	1,442,281	1,446,649	1,453,290	1,458,522	1,458,834	1,465,886
1,484,085	1,481,331	1,481,688	1,490,930	1,490,946	1,491,067	1,496,151
1,507,852	1,512,373	1,512,374	1,512,383	1,512,412	1,512,566	1,514,059
1,514,091	1,516,220	1,520,213	1,520,229			

56. Separate Gathering Pools

Re.12,323	77,479	128,716	229,846	230,667	230,668	233,566
246,109	256,748	270,594	296,227	310,804	320,951	329,970
330,307	311,103	387,818	405,317	407,187	416,703	434,184
439,029	447,795	451,287	452,462	455,486	463,149	469,406
487,286	492,820	514,487	517,675	518,851	521,537	545,630
549,427	563,293	578,058	587,673	602,111	617,690	629,557
675,200	698,980	725,173	748,169	756,409	759,354	764,300
767,373	776,196	778,553	804,775	808,358	809,925	836,731
847,632	849,021	854,273	892,379	895,206	908,151	928,175
935,789	958,535	1,000,546	1,000,921	1,013,486	1,032,598	1,035,865
1,035,866	1,050,544	1,074,167	1,083,616	1,115,933	1,115,934	1,125,588
1,127,115	1,127,245	1,128,269	1,130,536	1,131,788	1,135,973	1,145,815
1,152,833	1,163,487	1,163,583	1,163,584	1,163,585	1,166,793	1,166,794
1,172,674	1,174,720	1,187,025	1,188,107	1,199,763	1,203,333	1,214,349
1,231,776	1,243,564	1,248,372	1,251,931	1,276,465	1,293,533	1,294,581
1,298,474	1,321,752	1,324,917	1,324,918	1,327,405	1,347,181	1,363,622
1,366,745	1,372,044	1,375,941	1,438,402	1,469,457		

57. Reheating-Furnace

41,065	141,935	202,533	206,761	208,527	424,386	431,874
468,657	498,148	509,146	520,767	596,319	640,052	756,557
760,959	789,583	1,038,909	1,165,611			

58. Work-Manipulating

263,051	411,131	414,727	421,621	442,855	452,205	493,302
542,990	566,412	580,504	593,108	617,920	617,925	620,367
623,291	625,468	633,985	649,425	658,466	664,058	682,595
696,500	702,633	707,045	709,727	727,294	737,400	742,601
746,498	760,104	766,193	772,901	780,864	794,755	810,461
826,701	829,196	834,275	843,238	844,472	854,793	854,836
858,484	877,923	886,351	892,433	899,473	931,663	953,337
959,500	962,861	962,862	962,863	1,009,249	1,109,131	1,118,976
1,135,640	1,152,969	1,176,151	1,181,771	1,205,675	1,274,095	1,307,453
1,362,756	1,364,939	1,383,171	1,473,675	1,515,793		

59. Pot-Furnaces

N. Stanford, Oct. 5, 1825						
4,770	4,783	10,830	11,893	29,342	48,903	60,307
62,887	63,241	88,066	127,806	130,154	133,083	153,810
156,743	171,241	171,876	177,130	194,043	213,289	213,858
226,608	239,763	241,097	254,653	283,462	319,688	323,937
324,307	330,473	347,045	376,029	398,296	416,008	450,043
451,836	476,672	483,915	485,340	501,236	521,147	630,464
675,015	691,250	698,932	757,666	774,600	779,235	820,124
889,832	925,864	1,016,105	1,017,391	1,021,798	1,104,375	1,147,699
1,152,828	1,369,453	1,370,673	1,469,358	1,476,432		

60. Melting Pots

31,011	51,068	64,558	71,578	80,623	93,839	102,502
134,789	152,687	153,631	175,081	188,129	198,628	209,606
233,904	265,966	287,355	298,772	409,368	426,820	484,161
485,788	528,710	807,804	829,200	856,449	987,212	1,016,065
1,200,889	1,223,959	1,471,824	1,475,650			

61. Floats

Re.9,418	189,800	242,845	434,931	677,028	1,130,537	1,132,270
1,155,507	1,167,534	1,179,251	1,179,252	1,203,423	1,212,031	1,225,541
1,225,542	1,236,240	1,240,937	1,258,159	1,267,945	1,267,949	1,342,080
1,367,027						

62. Gathering and Lading

14,838	360,552	570,879	584,138	605,483	618,973	618,974
618,975	631,195	695,156	697,886	700,428	744,274	758,553
768,970	771,315	777,809	781,439	800,644	805,875	820,613
832,118	838,768	842,051	846,057	870,649	879,889	881,096
904,402	960,264	1,000,224	1,024,228	1,037,362	1,037,363	1,037,366
1,040,346	1,117,322	1,147,438	1,156,379	1,161,246	1,204,583	1,204,878
1,208,791	1,222,243	1,223,393	1,232,494	1,251,671	1,304,568	1,311,249
1,324,464	1,350,552	1,417,684	1,453,285			

63. Batch Mixers

138,554	284,121	491,445	826,139	911,816	975,315	1,164,977
1,337,633	1,473,008					

64. Snaps and Sockets

17,960	36,364	51,058	54,572	54,991	71,447	145,945
172,734	176,525	233,672	241,976	292,685	294,946	357,868
480,458	508,854	536,241	572,308	606,736	634,276	704,790
805,830	1,004,260	1,390,627				

65. Molds

87,795	91,946	98,567	135,502	236,390	275,563	312,312
403,719	428,713	438,893	478,792	487,498	507,337	529,694
613,089	687,151	772,497	852,099	879,294	953,926	969,280
970,426	1,108,964	1,222,784	1,223,392	1,253,246	1,259,800	1,399,203
1,412,358	1,439,355	1,449,789	1,519,586			

66. Uniting Parts

3,892	Re.5,924	8,795	Re.9,904	Re.10,149	11,515	34,555
50,373	50,374	104,205	125,083	132,216	136,835	143,629
169,038	220,908	224,519	224,555	232,886	236,022	243,281
256,158	260,498	263,621	263,931	314,828	411,969	423,264
466,062	486,182	490,905	499,085	507,849	509,250	511,491
586,388	588,013	681,530	793,684	850,577	907,489	949,571
1,153,126	1,266,786	1,297,122	1,405,034	1,439,667	1,455,853	1,509,978

67. Bending

280,143	417,097	682,570	682,571	787,438	833,436	840,843
991,025	1,107,476	1,111,958	1,161,998	1,236,937	1,236,938	

68. Cooling and Heating

Re.8,799	30,093	60,203	79,737	101,485	199,583	206,157
246,972	253,539	253,543	344,500	527,801	780,863	832,212
941,584	1,057,198					

69. Blowing

6,694	Re.6,886	Re.7,747	22,091	30,063	30,066	59,159
85,637	100,127	117,157	124,343	125,234	136,971	154,164
191,102	191,103	199,066	229,779	242,622	275,730	277,402
296,691	297,430	351,784	403,624	407,349	431,388	495,048
529,665	544,248	583,926	592,078	608,828	632,057	639,146
656,189	691,463	763,758	786,114	800,352	823,184	825,977
828,483	1,028,413	1,081,372	1,098,248	1,129,668	1,156,756	1,259,157
1,276,647	1,331,471	1,462,362				

70. Labelling

72,368	79,162	132,897	163,276	170,464	174,514	196,855
453,875	476,649	490,966	839,987	992,830		

71. Vented

Re.6,903	22,129	50,105	143,864	149,461	215,869	236,140
246,312	342,318	360,076	417,176	736,790		

72. Pressing

2,226	Re.3,181	5,303	Re.10,397	21,487	24,360	27,873
50,185	52,338	79,892	82,983	87,506	93,591	157,611
159,062	162,234	168,863	169,103	170,839	171,394	182,073
214,779	242,638	265,300	267,659	278,745	279,402	296,793
319,026	404,765	595,258	595,267	595,274	618,671	653,463
833,047	856,154	858,812	875,567	886,146	898,223	907,386
911,679	917,469	925,782	942,651	975,409	1,116,126	1,177,177
1,230,367	1,259,280	1,390,754	1,449,808	1,455,643	1,465,724	1,466,640

73. Laterally-Separable Sides

34,424	68,633	75,604	83,210	90,040	91,118	115,377
145,144	147,302	154,184	162,216	163,539	163,787	164,517
179,647	216,134	234,300	234,564	239,772	256,663	266,299
276,327	281,610	285,496	286,096	297,078	300,691	301,427
314,971	321,498	342,743	343,520	355,649	357,867	359,553
364,929	388,556	458,189	576,966	599,939	657,626	662,759
696,430	724,179	729,439	786,116	793,280	801,461	830,057
900,037	952,279	959,423	1,019,147	1,177,177	1,278,336	1,474,329

74. Helically Separable

84,412	196,733	270,162	330,545	415,868	486,392	634,107
771,483						

75. Clamping

64,312	126,099	274,790	297,077	653,140	692,038	

76. Cores and Plungers

132,214	132,215	206,111	217,050	278,472	291,072	301,329
304,748	306,146	306,147	462,862	627,093	627,094	635,311
639,509	658,088	821,610	913,212	1,159,992	1,274,673	1,290,738
1,326,365	1,342,056	1,439,372				

77. Processes

9,789	Re.12,789	55,159	179,906	196,092	216,830	221,139
262,388	276,987	342,989	351,413	364,324	403,026	421,620
460,358	496,334	531,874	531,875	629,973	674,620	675,016
723,139	744,245	745,863	752,674	766,514	766,771	776,460
780,267	782,967	785,441	787,122	791,827	792,123	805,068
805,139	805,943	805,963	807,066	807,459	813,123	814,773
828,147	828,485	839,054	847,396	889,354	905,044	941,512
986,380	993,555	1,002,234	1,002,954	1,004,086	1,107,528	1,123,016
1,125,468	1,133,244	1,137,814	1,143,317	1,149,451	1,157,597	1,159,579
1,169,571	1,173,688	1,175,224	1,180,565	1,186,076	1,194,124	1,196,848
1,199,108	1,205,018	1,212,189	1,217,240	1,231,610	1,241,229	1,242,537
1,255,884	1,269,791	1,274,577	1,275,424	1,277,256	1,277,795	1,278,014
1,315,668	1,328,530	1,334,725	1,342,042	1,342,960	1,351,710	1,352,700
1,360,585	1,410,741	1,415,824	1,422,216	1,451,361	1,460,888	1,466,575
1,466,973	1,475,473	1,476,431	1,519,802			

*Glass Engineer, Pittsburgh, Pa.

77.5 Slag

Re.252	9,459	11,692	130,578	162,932	195,889	221,649
245,466	278,002	281,248	300,580	400,046	400,047	429,225
429,226	637,126	675,205	710,882	779,307	810,022	887,188
945,583	959,720	980,606	1,058,158	1,071,605	1,076,657	1,114,581
1,171,676	1,242,537	1,259,304	1,331,377	1,402,363	1,458,858	1,471,421

78. Incandescent-Lamp Making

264,517	282,472	305,191	324,334	335,831	358,492	397,479
430,156	453,742	481,047	520,088	640,419	770,222	774,708
789,515	810,466	818,674	825,103	829,539	831,396	850,029
866,301	872,530	908,378	941,996	966,571	1,016,320	1,120,064
1,238,575	1,315,813	1,349,686				

78.1 Quartz Glass

Re.13,504	805,302	805,303	812,399	816,707	816,708	822,424
1,077,704	1,107,386	1,107,387	1,169,681	1,330,611	1,343,686	1,375,657
1,512,511						

79. Combined

Re.6,904	Re.10,712	Re.10,753	133,947	184,604	205,981	235,522
240,686	246,478	268,266	268,849	273,371	275,996	292,663
314,969	314,970	331,395	331,824	337,656	341,141	342,319
343,133	344,415	346,984	359,682	379,089	389,595	398,995
425,939	487,425	511,568	514,495	523,133	530,289	543,656
562,679	568,591	587,809	599,716	625,065	628,030	631,196
632,008	637,038	652,091	673,847	687,011	687,012	695,283
695,284	699,058	709,796	719,511	730,078	735,732	747,335
753,694	756,284	756,558	756,895	764,501	770,867	816,463
817,963	836,298	896,631	915,783	934,094	1,048,227	1,059,634
1,060,583	1,107,072	1,125,760	1,155,000	1,175,150	1,178,256	1,178,257
1,179,155	1,210,572	1,239,051	1,247,031	1,289,993	1,317,481	1,332,729
1,368,958	1,370,042	1,382,650	1,416,947	1,420,996	1,454,200	1,474,403
1,159,277						

80. Molding and Blowing

34,345	57,063	184,293	260,819	292,765	321,369	352,641
359,489	364,298	376,915	393,257	403,023	406,692	416,149
435,936	466,894	477,336	564,825	570,896	604,959	625,985
651,059	656,287	656,876	672,717	688,924	690,233	703,618
704,760	725,497	730,077	735,796	742,506	744,007	760,150
763,849	771,581	786,115	792,606	793,906	809,418	826,827
851,163	852,098	1,004,258	1,013,451	1,021,048	1,024,264	1,035,387
1,061,405	1,127,381	1,148,213	1,148,215	1,163,963	1,165,212	1,231,751
1,235,008	1,272,861	1,272,862	1,299,482			

81. Uniting Parts

37,591	42,931	70,325	74,804	110,815	151,435	170,218
177,425	197,869	225,816	226,770	230,709	267,924	301,100
331,764	342,045	430,041	476,648	479,365	494,063	610,776
623,919	624,923	658,457	660,809	667,646	732,812	805,595
966,784	988,424	1,009,022	1,048,528	1,098,342	1,128,094	1,165,951
1,182,739	1,223,135	1,230,548	1,274,205	1,293,441	1,294,466	1,324,361
1,342,267	1,342,268	1,421,974	1,452,275	1,478,862		

82. Glass to Glass

Re.3,116	Re.6,151	1,068	Re.13,332	47,101	77,042	79,298
143,863	155,403	159,519	167,608	172,946	174,178	179,951
181,618	182,242	189,180	191,534	202,647	204,272	237,371
240,685	244,246	247,100	275,564	293,977	297,276	298,145
309,731	345,264	345,265	361,723	373,117	432,412	451,618
452,452	452,722	484,277	502,344	502,461	503,825	504,552
523,152	669,381	672,153	706,863	718,381	748,849	748,850
762,925	772,876	793,685	865,136	909,842	918,503	923,136
952,527	952,908	960,146	1,002,955	1,002,956	1,004,257	1,004,259
1,012,547	1,056,971	1,206,177	1,255,979	1,266,785	1,274,576	1,335,544
1,388,126	1,387,337	1,403,268	1,448,351			

82.1 Bi-Focal Lenses

827,500	848,335	861,055	865,363	869,938	887,028	890,813
901,575	901,576	901,659	914,316	930,826	1,024,486	1,026,182
1,153,859	1,157,410	1,157,411	1,157,470	1,165,978	1,180,395	1,190,242
1,282,877	1,312,920	1,350,441	1,373,633	1,400,061	1,436,217	1,441,566
1,449,343	1,450,711	1,451,490				

83. Blowing

75,110	109,646	169,479	171,971	186,986	191,224	207,241
243,447	266,918	276,924	307,244	337,692	414,586	472,631
496,416	498,147	615,910	637,899	717,501	722,386	759,718
759,742	843,594	860,957	1,016,832	1,100,811	1,242,444	1,464,698

83.1 Drawing

Re.14,082	679,293	682,980	702,014	702,016	739,329	762,879
762,880	766,274	769,642	788,142	805,065	807,298	814,612
822,212	822,678	832,835	840,838	841,011	841,193	841,594
852,197	883,039	890,869	915,899	918,323	939,101	958,840
972,616	1,020,920	1,044,139	1,085,066	1,085,835	1,119,006	1,119,328
1,119,867	1,136,290	1,136,362	1,142,139	1,163,754	1,164,007	1,208,851
1,218,598	1,241,480	1,242,444	1,273,346	1,283,333	1,295,158	1,295,348
1,301,771	1,306,651	1,307,946	1,309,274	1,344,325	1,356,739	1,364,895
1,367,858	1,376,975	1,394,283	1,396,339	1,469,382	1,475,527	1,505,584

84. Reshaping

94,113	124,195	156,569	164,374	193,314	196,663	246,474
257,385	335,987	351,197	351,216	372,253	375,796	410,546
411,043	497,574	580,716	599,887	628,027	643,223	655,728
695,782	742,345	742,602	789,302	792,608	842,233	862,648
916,250	917,470	960,587	1,042,857	1,146,910	1,180,383	1,199,484
1,230,368	1,256,427	1,301,714	1,308,820	1,318,170	1,372,294	1,445,641
1,479,801	1,497,798	1,497,799				

85. Molding

Re.8,400	9,184	43,224	113,393	114,140	142,573	144,061
192,537	250,933	253,540	253,541	258,402	265,206	324,157
374,546	414,144	688,923	694,685	754,165	756,022	793,299
798,642	835,393	865,314	925,824	985,785	1,075,794	1,211,120
1,406,502	1,465,545	1,482,760				

86. Wire-Glass

19,964	220,907	222,768	243,282	483,021	510,822	516,220
529,377	533,512	535,035	548,520	646,132	656,295	677,609
727,006	727,007	736,310	741,125	753,101	761,204	773,305
773,307	776,158	786,058	788,147	792,172	797,646	804,821
835,148	844,484	844,485	844,552	844,767	847,637	851,787
861,879	862,096	867,510	874,380	875,857	880,772	938,385
980,063	1,062,013	1,104,054	1,135,371	1,135,937	1,156,213	1,199,365
1,259,772	1,395,963	1,418,236				

87. Sheets and Plates

9,791	185,428	370,176	396,511	462,529	506,215	588,574
628,120	661,025	676,612	683,863	689,047	710,357	724,344
734,125	739,338	742,027	742,898	747,913	779,280	782,394
789,191	793,866	798,643	798,644	798,645	814,631	827,484
831,914	839,724	867,931	877,729	890,293	904,158	911,678
949,183	950,864	952,290	972,165	972,168	1,039,829	1,090,904
1,108,205	1,162,114	1,175,117	1,217,340	1,261,366	1,298,893	1,305,286
1,397,287	1,465,347					

88. Heat Developed Coloring

Re.10,446	282,002	288,582	366,364	382,105	402,090

89. Annealing

Re.6,971	170,339	176,066	476,067	202,544	202,809	210,731
223,637	342,260	363,087	684,056	741,494	928,860	957,477
1,483,461						

92. Structure

Re.3,555	Re.6,895	Re.6,973	Re.8,399	35,429	35,430	132,208
164,669	212,682	232,122	246,841	249,745	302,747	314,069
334,754	337,170	343,823	345,436	355,486	363,190	419,882
439,447	481,805	524,936	621,360	626,655	676,799	686,009
723,014	727,005	764,991	773,174	773,306	830,398	831,640
889,978	912,950	990,303	1,019,660	1,041,329	1,085,432	1,156,214
1,187,346	1,197,474	1,241,767	1,342,282	1,345,792	1,355,625	1,438,188
1,438,428	1,438,470	1,450,330	1,467,030			

Note—

Sub-class 49 was eliminated by the re-classification of 1920, see Class 88, sub-class 57.

Sub-class 51 was eliminated by the re-classification of 1920.

Sub-class 90 was eliminated by the re-classification of 1920, see Class 106, sub-class 36.1.

Sub-class 91 was eliminated by the re-classification of 1920, see Class 106

A Numerical Index to United States Patents

T. E. Kirch*

While examining a long list of patent numbers which were not furnished with dates I found it rather bothersome to pull down several volumes of the Patent Office Gazette before the desired number could be located. Not being able to find an index which would help me I prepared a key by years which finally grew into this index by volumes.

The first column is the patent numbers beginning with the first issue of the Gazette in 1872. Any patent in these numbers, inclusive, will be found in the volume number following. The period covered by each volume is in the third column. This period has been one month since the issue of December, 1902. I find this close enough to the exact date of issue for most cases and have often used this index instead of looking up the date in the Gazette. It has been invaluable on occasions when the Gazette was not available. I hope it will be of as much use to my friends.

*Glass Engineer, Pittsburgh, Pa.

Patent Numbers	Volume of Gazette	Date of Gazette
122,304- 128,450	1	Jan. 2-June 25, 1872
128,451- 134,503	2	July 2-Dec. 31, 1872
134,504- 140,335	3	Jan. 7-June 24, 1873
140,336- 146,119	4	July 1-Dec. 30, 1873
146,120- 152,718	5	Jan. 6-June 30, 1874
152,719- 158,349	6	July 7-Dec. 29, 1874
158,350- 165,145	7	Jan. 5-June 29, 1875
165,146- 171,640	8	July 6-Dec. 28, 1875
171,641- 179,387	9	Jan. 4-June 27, 1876
179,388- 185,812	10	July 4-Dec. 27, 1876
185,813- 192,555	11	Jan. 2-June 26, 1877
192,556- 198,732	12	July 3-Dec. 25, 1877
193,733- 205,461	13	Jan. 1-June 25, 1878
205,462- 211,077	14	July 2-Dec. 31, 1878
211,078- 216,928	15	Jan. 7-June 24, 1879
216,929- 223,210	16	July 1-Dec. 30, 1879
223,211- 229,512	17	Jan. 6-June 29, 1880
229,513- 236,136	18	July 6-Dec. 28, 1880
236,137- 243,679	19	Jan. 4-June 28, 1881
243,680- 251,684	20	July 5-Dec. 27, 1881
251,685- 260,349	21	Jan. 3-June 27, 1882
260,350- 269,819	22	July 4-Dec. 26, 1882
269,820- 280,337	23	Jan. 2-June 26, 1883
280,338- 285,777	24	July 3-Sept. 25, 1883
285,778- 291,015	25	Oct. 2-Dec. 25, 1883
291,016- 295,892	26	Jan. 1-Mar. 25, 1884
295,893- 301,077	27	Apr. 1-June 24, 1884
301,078- 306,043	28	July 1-Sept. 30, 1884
306,044- 310,162	29	Oct. 7-Dec. 30, 1884
310,163- 314,985	30	Jan. 6-Mar. 31, 1885
314,986- 321,412	31	Apr. 7-June 30, 1885
321,413- 327,508	32	July 7-Sept. 29, 1885

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327,509- 333,493	33	Oct. 6-Dec. 29, 1885
333,494- 339,123	34	Jan. 5-Mar. 30, 1886
339,124- 344,802	35	Apr. 6-June 29, 1886
344,803- 350,094	36	July 6-Sept. 28, 1886
350,095- 355,290	37	Oct. 6-Dec. 28, 1886
355,291- 360,401	38	Jan. 4-Mar. 29, 1887
360,402- 365,768	39	Apr. 5-June 28, 1887
365,769- 370,753	40	July 5-Sept. 27, 1887
370,754- 375,719	41	Oct. 4-Dec. 27, 1887
375,720- 380,305	42	Jan. 3-Mar. 27, 1888
380,306- 385,335	43	Apr. 3-June 26, 1888
385,336- 390,195	44	July 3-Sept. 25, 1888
390,196- 395,304	45	Oct. 2-Dec. 25, 1888
395,305- 400,421	46	Jan. 1-Mar. 26, 1889
400,422- 406,017	47	Apr. 2-June 25, 1889
406,018- 411,771	48	July 2-Sept. 24, 1889
411,772- 418,664	49	Oct. 1-Dec. 31, 1889
418,665- 424,444	50	Jan. 7-Mar. 25, 1890
424,445- 431,025	51	Apr. 1-June 24, 1890
431,026- 437,672	52	July 1-Sept. 30, 1890
437,673- 443,986	53	Oct. 7-Dec. 30, 1890
443,987- 449,652	54	Jan. 6-Mar. 31, 1891
449,653- 455,295	55	Apr. 7-June 30, 1891
455,296- 460,545	56	July 7-Sept. 29, 1891
460,546- 466,314	57	Oct 6-Dec. 29, 1891
466,315- 472,019	58	Jan. 5-Mar. 29, 1892
472,020- 478,074	59	Apr. 5-June 28, 1892
478,075- 483,517	60	July 5-Sept. 27, 1892
483,518- 488,975	61	Oct. 4-Dec. 27, 1892
488,976- 494,539	62	Jan. 3-Mar. 28, 1893
494,540- 500,543	63	Apr. 4-June 27, 1893
500,544- 505,804	64	July 4-Sept. 26, 1893
505,805- 511,743	65	Oct. 3-Dec. 26, 1893
511,744- 517,419	66	Jan. 2-Mar. 27, 1894
517,420- 522,185	67	Apr. 3-June 26, 1894
522,186- 526,670	68	July 3-Sept. 25, 1894
526,671- 531,618	69	Oct. 2-Dec. 25, 1894
531,619- 536,590	70	Jan. 1-Mar. 25, 1895
536,591- 541,819	71	Apr. 2-June 25, 1895
541,820- 546,980	72	July 2-Sept. 24, 1895
546,981- 552,501	73	Oct. 1-Dec. 31, 1895
552,502- 557,531	74	Jan. 7-Mar. 31, 1896
557,532- 563,246	75	Apr. 7-June 30, 1896
563,247- 568,723	76	July 7-Sept. 29, 1896
568,724- 574,368	77	Oct. 6-Dec. 29, 1896
574,369- 579,943	78	Jan. 5-Mar. 30, 1897
579,944- 585,644	79	Apr. 6-June 29, 1897
585,645- 590,949	80	July 6-Sept. 28, 1897
590,950- 596,466	81	Oct. 5-Dec. 28, 1897
596,467- 601,622	82	Jan. 4-Mar. 29, 1898
601,623- 606,636	83	Apr. 5-June 28, 1898
606,637- 611,594	84	July 5-Sept. 27, 1898
611,595- 616,870	85	Oct. 4-Dec. 27, 1898
616,871- 622,194	86	Jan. 3-Mar. 28, 1899
622,195- 627,960	87	Apr. 4-June 27, 1899
627,961- 633,979	88	July 4-Sept. 26, 1899
633,980- 640,166	89	Oct. 3-Dec. 26, 1899
640,167- 646,404	90	Jan. 2-Mar. 27, 1900
646,405- 649,893	91 part 1	Apr. 3-May 15, 1900
649,894- 652,737	91 " 2	May 22-June 26, 1900
652,738- 656,156	92 " 1	July 3-Aug. 14, 1901
656,157- 658,746	92 " 2	Aug. 21-Sept. 25, 1901
658,747- 661,941	93 " 1	Oct. 2-Nov. 13, 1901
661,942- 664,826	93 " 2	Nov. 20-Dec. 25, 1901
664,827- 668,148	94 " 1	Jan. 1-Feb. 12, 1901
668,149- 670,922	94 " 2	Feb. 19-March 23, 1901
670,923- 674,361	95 " 1	April 2-May 14, 1901
674,362- 677,330	95 " 2	May 21-June 25, 1901
677,331- 680,678	96 " 1	July 2-Aug. 13, 1901
680,679- 683,423	96 " 2	Aug. 20-Sept. 24, 1901
683,424- 686,692	97 " 1	Oct. 1-Nov. 12, 1901
686,693- 690,384	97 " 2	Nov. 19-Dec. 31, 1901
690,385- 693,358	98 " 1	Jan. 7-Feb. 11, 1902
693,359- 696,392	98 " 2	Feb. 18-March 25, 1902
696,393- 700,163	99 " 1	April 1-May 13, 1902
700,164- 703,361	99 " 2	May 20-June 30, 1902
703,362- 707,067	100 " 1	July 1-Aug. 12, 1902
707,068- 710,397	100 " 2	Aug. 19-Sept. 30, 1902
710,398- 714,152	101 " 1	Oct. 7-Nov. 25, 1902
714,653- 717,520	101 " 2	Dec. 2-Dec. 30, 1902
717,521- 719,412	102 " 1	Jan. 1903
719,413- 721,651	102 " 2	Feb. 1903
721,652- 724,415	103 " 1	March 1903
724,416- 726,836	103 " 2	April 1903
726,837- 729,520	104 " 1	May 1903
729,521- 732,690	104 " 2	June 1903
732,691- 735,046	105 " 1	July 1903
735,047- 737,560	105 " 2	Aug. 1903
737,561- 740,383	106 " 1	Sept. 1903
740,384- 742,817	106 " 2	Oct. 1903
742,818- 745,310	107 " 1	Nov. 1903
745,311- 748,566	107 " 2	Dec. 1903
748,567- 750,787	108 " 1	Jan. 1904
750,788- 753,216	108 " 2	Feb. 1904
753,217- 756,197	109 " 1	March 1904
756,198- 758,607	109 " 2	April 1904
758,608- 761,636	110 " 1	May 1904
761,637- 763,947	110 " 2	June 1904
763,948- 766,158	111 " 1	July 1904
766,159- 769,140	111 " 2	Aug. 1904
769,141- 771,218	112 " 1	Sept. 1904
771,219- 773,532	112 " 2	Oct. 1904
773,533- 776,480	113 " 1	Nov. 1904
776,481- 778,833	113 " 2	Dec. 1904
778,834- 781,628	114 " 1	Jan. 1905
781,629- 784,018	114 " 2	Feb. 1905
784,019- 786,253	115 " 1	March 1905
786,254- 788,505	115 " 2	April 1905
788,506- 791,441	116 " 1	May 1905
791,442- 793,627	116 " 2	June 1905
793,628- 795,803	117 " 1	July 1905
795,804- 798,588	117 " 2	Aug. 1905
798,589- 800,618	118 " 1	Sept. 1905
800,619- 803,535	118 " 2	Oct. 1905
803,536- 806,089	119 " 1	Nov. 1905
806,090- 808,617	119 " 2	Dec. 1905
808,618- 811,532	120 " 1	Jan. 1906
811,533- 814,006	120 " 2	Feb. 1906
814,007- 816,551	121 " 1	March 1906
816,552- 819,033	121 " 2	April 1906
819,034- 822,231	122 " 1	May 1906

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822,232- 824,697	122 part 2	June 1906
824,698- 827,697	123 " 1	July 1906
827,698- 829,938	123 " 2	Aug. 1906
829,939- 832,026	124 " 1	Sept. 1906
832,027- 834,876	124 " 2	Oct. 1906
834,877- 837,269	125 " 1	Nov. 1906
837,270- 839,798	125 " 2	Dec. 1906
839,799- 842,848	126 " 1	Jan. 1907
842,849- 845,735	126 " 2	Feb. 1907
845,736- 848,616	127 " 1	March 1907
848,617- 852,408	127 " 2	April 1907
852,409- 855,438	128 " 1	May 1907
855,439- 858,360	128 " 2	June 1907
858,361- 862,121	129 " 1	July 1907
862,122- 864,764	129 " 2	Aug. 1907
864,765- 867,225	130 " 1	Sept. 1907
867,226- 869,869	130 " 2	Oct. 1907
869,870- 872,318	131 " 1	Nov. 1907
872,319- 875,678	131 " 2	Dec. 1907
875,679- 877,896	132 " 1	Jan. 1908
877,897- 880,490	132 " 2	Feb. 1908
880,491- 883,683	133 " 1	March 1908
883,684- 886,335	133 " 2	April 1908
886,336- 889,185	134 " 1	May 1908
889,186- 892,387	134 " 2	June 1908
892,388- 894,804	135 " 1	July 1908
894,805- 897,262	135 " 2	Aug. 1908
897,263- 900,073	136 " 1	Sept. 1908
900,074- 902,541	136 " 2	Oct. 1908
902,542- 905,126	137 " 1	Nov. 1908
905,127- 908,435	137 " 2	Dec. 1908
908,436- 911,021	138	Jan. 1909
911,022- 913,676	139	Feb. 1909
913,677- 916,959	140	March 1909
916,960- 920,103	141	April 1909
920,104- 923,129	142	May 1909
923,130- 926,719	143	June 1909
926,720- 929,645	144	July 1909
929,646- 933,042	145	Aug. 1909
933,043- 935,628	146	Sept. 1909
935,629- 938,454	147	Oct. 1909
938,455- 942,044	148	Nov. 1909
942,045- 945,009	149	Dec. 1909
945,010- 947,778	150	Jan. 1910
947,779- 950,467	151	Feb. 1910
950,468- 953,678	152	March 1910
953,679- 956,506	153	April 1910
956,507- 960,242	154	May 1910
960,243- 963,027	155	June 1910
963,028- 965,846	156	July 1910
965,847- 969,146	157	Aug. 1910
969,150- 971,511	158	Sept. 1910
971,512- 974,106	159	Oct. 1910
974,107- 977,424	160	Nov. 1910
977,425- 980,177	161	Dec. 1910
980,178- 983,259	162	Jan. 1911
983,260- 985,764	163	Feb. 1911
985,765- 988,294	164	March 1911
988,295- 990,827	165	April 1911
990,828- 994,104	166	May 1911
994,105- 996,600	167	June 1911
996,601- 999,193	168	July 1911
999,194-1,002,209	169	Aug. 1911
1,002,210-1,004,549	170	Sept. 1911
1,004,550-1,007,659	171	Oct. 1911
1,007,660-1,010,406	172	Nov. 1911
1,010,407-1,013,094	173	Dec. 1911
1,013,095-1,016,244	174	Jan. 1912
1,016,245-1,019,011	175	Feb. 1912
1,019,012-1,021,755	176	March 1912
1,021,756-1,025,113	177	April 1912
1,025,114-1,028,092	178	May 1912
1,028,093-1,030,855	179	June 1912
1,030,856-1,034,405	180	July 1912
1,034,406-1,037,186	181	Aug. 1912
1,037,187-1,039,681	182	Sept. 1912
1,039,682-1,043,057	183	Oct. 1912
1,043,058-1,045,802	184	Nov. 1912
1,045,803-1,049,325	185	Dec. 1912
1,049,326-1,051,852	186	Jan. 1913
1,051,853-1,054,659	187	Feb. 1913
1,054,660-1,057,397	188	March 1913
1,057,398-1,060,571	189	April 1913
1,060,572-1,063,176	190	May 1913
1,063,177-1,065,912	191	June 1913
1,065,913-1,069,094	192	July 1913
1,069,095-1,071,679	193	Aug. 1913
1,071,680-1,074,593	194	Sept. 1913
1,074,594-1,077,244	195	Oct. 1913
1,077,248-1,079,928	196	Nov. 1913
1,079,929-1,083,266	197	Dec. 1913
1,083,267-1,085,586	198	Jan. 1914
1,085,587-1,088,675	199	Feb. 1914
1,088,676-1,092,130	200	March 1914
1,092,131-1,095,181	201	April 1914
1,095,182-1,098,365	202	May 1914
1,098,366-1,102,226	203	June 1914
1,102,227-1,105,596	204	July 1914
1,105,597-1,108,873	205	Aug. 1914
1,108,874-1,112,426	206	Sept. 1914
1,112,427-1,115,475	207	Oct. 1914
1,115,476-1,118,913	208	Nov. 1914
1,118,914-1,123,211	209	Dec. 1914
1,123,212-1,126,676	210	Jan. 1915
1,126,677-1,129,837	211	Feb. 1915
1,129,838-1,134,088	212	Mar. 1915
1,134,089-1,137,726	213	April 1915
1,137,727-1,141,094	214	May 1915
1,141,095-1,144,985	215	June 1915
1,144,986-1,148,491	216	July 1915
1,148,492-1,152,387	217	Aug. 1915
1,152,388-1,155,330	218	Sept. 1915
1,155,331-1,158,420	219	Oct. 1915
1,158,421-1,162,736	220	Nov. 1915
1,162,737-1,166,418	221	Dec. 1915
1,166,419-1,169,754	222	Jan. 1916
1,169,755-1,174,032	223	Feb. 1916
1,174,033-1,177,587	224	March 1916
1,177,588-1,181,101	225	April 1916
1,181,102-1,185,613	226	May 1916
1,185,614-1,189,220	227	June 1916

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1,189,221-1,192,836	228	July 1916
1,192,837-1,196,750	229	Aug. 1916
1,196,751-1,199,749	230	Sept. 1916
1,199,750-1,203,560	231	Oct. 1916
1,203,561-1,206,788	232	Nov. 1916
1,206,789-1,210,388	233	Dec. 1916
1,210,389-1,214,492	234	Jan. 1917
1,214,493-1,217,893	235	Feb. 1917
1,217,894-1,221,008	236	March 1917
1,221,009-1,224,123	237	April 1917
1,224,124-1,228,382	238	May 1917
1,228,383-1,231,548	239	June 1917
1,231,549-1,235,538	240	July 1917
1,235,539-1,238,728	241	Aug. 1917
1,238,729-1,241,485	242	Sept. 1917
1,241,486-1,245,148	243	Oct. 1917
1,245,149-1,248,434	244	Nov. 1917
1,248,435-1,251,457	245	Dec. 1917
1,251,458-1,255,120	246	Jan. 1918
1,255,121-1,257,961	247	Feb. 1918
1,257,962-1,260,998	248	March 1918
1,260,999-1,264,879	249	April 1918
1,264,880-1,268,078	250	May 1918
1,268,079-1,270,761	251	June 1918
1,270,762-1,274,360	252	July 1918
1,274,361-1,277,345	253	Aug. 1918
1,277,346-1,280,127	254	Sept. 1918
1,280,128-1,283,445	255	Oct. 1918
1,283,446-1,286,193	256	Nov. 1918
1,286,194-1,290,026	257	Dec. 1918
1,290,027-1,292,982	258	Jan. 1919
1,292,983-1,295,832	259	Feb. 1919
1,295,833-1,298,632	260	March 1919
1,298,633-1,302,489	261	April 1919
1,302,490-1,305,241	262	May 1919
1,305,242-1,308,020	263	June 1919
1,308,021-1,311,864	264	July 1919
1,311,865-1,314,491	265	Aug. 1919
1,314,492-1,317,671	266	Sept. 1919
1,317,672-1,320,368	267	Oct. 1919
1,320,369-1,323,235	268	Nov. 1919
1,323,236-1,326,898	269	Dec. 1919
1,326,899-1,329,351	270	Jan. 1920
1,329,352-1,332,191	271	Feb. 1920
1,332,192-1,335,716	272	March 1920
1,335,717-1,338,662	273	April 1920
1,338,663-1,341,626	274	May 1920
1,341,627-1,345,336	275	June 1920
1,345,337-1,348,144	276	July 1920
1,348,145-1,351,726	277	Aug. 1920
1,351,727-1,354,460	278	Sept. 1920
1,354,461-1,357,211	279	Oct. 1920
1,357,212-1,360,993	280	Nov. 1920

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1,360,994-1,364,062	281	Dec. 1920
1,364,063-1,366,894	282	Jan. 1921
1,366,895-1,369,764	283	Feb. 1921
1,369,765-1,373,393	284	March 1921
1,373,394-1,376,390	285	April 1921
1,376,391-1,380,336	286	May 1921
1,380,337-1,383,273	287	June 1921
1,383,274-1,385,976	288	July 1921
1,385,977-1,389,569	289	Aug. 1921
1,389,570-1,392,287	290	Sept. 1921
1,392,288-1,395,242	291	Oct. 1921
1,395,243-1,398,953	292	Nov. 1921
1,398,954-1,401,947	293	Dec. 1921
1,401,948-1,405,380	294	Jan. 1922
1,405,381-1,408,425	295	Feb. 1922
1,408,426-1,411,248	296	March 1922
1,411,249-1,414,332	297	April 1922
1,414,333-1,418,267	298	May 1922
1,418,268-1,421,356	299	June 1922
1,421,357-1,424,144	300	July 1922
1,424,145-1,427,765	301	Aug. 1922
1,427,766-1,430,525	302	Sept. 1922
1,430,526-1,434,357	303	Oct. 1922
1,434,358-1,437,387	304	Nov. 1922
1,437,388-1,440,361	305	Dec. 1922
1,440,362-1,443,939	306	Jan. 1923
1,443,940-1,447,165	307	Feb. 1923
1,447,166-1,450,162	308	March 1923
1,450,163-1,453,259	309	April 1923
1,453,260-1,457,291	310	May 1923
1,457,292-1,460,360	311	June 1923
1,460,361-1,463,781	312	July 1923
1,463,782-1,466,654	313	Aug. 1923
1,466,655-1,469,205	314	Sept. 1923
1,469,206-1,472,777	315	Oct. 1923
1,472,778-1,475,924	316	Nov. 1923
1,475,925-1,478,995	317	Dec. 1923
1,478,996-1,482,375	318	Jan. 1924
1,482,376-1,485,355	319	Feb. 1924
1,485,356-1,488,460	320	March 1924
1,488,461-1,492,549	321	April 1924
1,492,550-1,495,977	322	May 1924
1,495,978-1,499,323	323	June 1924
1,499,324-1,503,460	324	July 1924
1,503,461-1,506,730	325	Aug. 1924
1,506,731-1,510,451	326	Sept. 1924
1,510,452-1,513,727	327	Oct. 1924
1,513,728-1,517,239	328	Nov. 1924
1,517,240-1,521,589	329	Dec. 1924
1,521,590-1,524,646	330	Jan. 1925
1,524,647-1,527,966	331	Feb. 1925
1,527,967-1,532,112	332	March 1925
1,532,113-	333	April 1925

Flow of Air in Pipes

Equalization Table

The table reproduced below, through the courtesy of W. S. Mayers, Chief Engineer, Monongah Glass Company, Fairmont, West Virginia, shows equation of piping relating to the flow of air and other gases in pipes. It has been found useful in designing fan piping around glass furnaces.

The table is based upon the laws of friction of gases in pipes and is designed to equalize the combined capacities of a number of small pipes to that of the main conduit. It applies to any fixed gas and is independent of pressure.

EXAMPLE.—It is desired to connect thirty 8 inch pipes to one main, the problem being to determine the diameter of the latter. The usual rule would be to multiply the area of an 8 inch pipe by 30, resulting in a 44 inch main. By the table it will be seen that thirty 8 inch pipes require a main of only 31 inches in diameter to carry the same volume of air with the same loss by friction.

Diameters of Mains \ Diameters of Branches	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	1																													
2	5.7	2																												
3	16	2.7	3																											
4	32	5.7	2.3	4																										
5	56	9.7	3.6	1.8	5																									
6	88	16	5.7	2.8	1.6	6																								
7	129	23	8.3	4.1	2.3	1.5	7																							
8	180	32	12	5.7	3.2	2.1	1.4	8																						
9	244	42	16	7.6	4.3	2.8	1.9	1.3	9																					
10	317	56	20	9.9	5.7	3.6	2.4	1.7	1.3	10																				
11	402	71	26	12	7.0	4.5	3.1	2.2	1.7	1.3	11																			
12	501	88	32	16	9	5.7	3.8	2.8	2.0	1.6	1.2	12																		
13	613	107	39	18	11	6.9	4.7	3.4	2.5	1.9	1.5	1.2	13																	
14	737	129	47	23	13	8.3	5.7	4.1	3.0	2.3	1.8	1.5	1.2	14																
15	876	152	56	27	16	9.9	6.7	4.8	3.6	2.6	2.2	1.8	1.4	1.2	15															
16	1024	180	65	32	18	11	7.9	5.7	4.2	3.2	2.6	2.1	1.7	1.4	1.2	16														
17	1187	208	76	37	21	13	9.2	6.6	4.9	3.8	2.9	2.4	2.0	1.6	1.4	1.2	17													
18	1375	239	88	43	24	16	10	7.7	5.7	4.3	3.4	2.8	2.3	1.9	1.6	1.3	1.2	18												
19	1580	275	100	49	28	18	12	8.8	6.5	5.0	3.9	3.2	2.6	2.2	1.8	1.5	1.3	1.2	19											
20	1775	312	114	56	32	20	14	9.8	7.4	5.7	4.5	3.6	2.9	2.5	2.1	1.7	1.5	1.3	1.1	20										
21	1985	345	130	61	35	22	15	10	8.4	6.3	5.2	4.1	3.2	2.6	2.3	2.0	1.6	1.4	1.2	1.1	21									
22	2250	398	145	71	41	26	18	13	9.3	7.2	5.7	4.5	3.7	3.1	2.6	2.2	1.9	1.7	1.4	1.3	1.1	22								
23	2535	460	169	77	47	29	20	14	10	7.8	6.2	5.0	4.1	3.4	2.8	2.4	2.1	1.8	1.6	1.4	1.2	1.1	23							
24	2800	493	180	88	50	32	22	16	12	8.9	7.6	5.7	4.6	3.8	3.2	2.9	2.4	2.1	1.8	1.6	1.3	1.2	1.1	24						
25	3060	543	202	97	55	35	24	17	13	10	8.0	6.4	5.2	4.2	3.5	3.1	2.6	2.2	2.0	1.7	1.5	1.3	1.2	1.1	25					
26	3125	580	218	108	62	39	27	19	14	11	8.6	6.9	5.7	4.7	4.0	3.4	2.9	2.5	2.2	1.9	1.7	1.5	1.3	1.2	1.1	26				
27	3738	677	243	121	68	43	29	21	15	12	9.6	7.5	6.1	5.1	4.3	3.6	3.1	2.7	2.4	2.1	1.9	1.6	1.5	1.3	1.2	1.1	27			
28	4100	725	265	129	74	48	32	23	17	13	10	8.3	6.8	5.7	4.8	4.1	3.5	3.0	2.6	2.3	2.1	1.8	1.6	1.5	1.3	1.2	1.1	28		
29	4440	800	289	141	78	52	35	25	19	14	11	9.1	7.5	6.2	5.2	4.4	3.8	3.3	2.9	2.5	2.2	2.0	1.8	1.6	1.4	1.3	1.2	1.1	29	
30	4838	864	315	151	88	56	38	28	20	16	12	9.9	8.0	6.7	5.7	4.7	4.1	3.6	3.0	2.6	2.4	2.2	1.8	1.7	1.5	1.4	1.3	1.2	1.1	30
31	5312	920	344	168	96	59	40	30	22	17	13	10	8.9	7.4	6.1	5.1	4.5	3.9	3.4	3.0	2.7	2.4	2.1	1.9	1.7	1.5	1.4	1.3	1.2	1.1
32	5431	1070	374	184	103	63	42	32	23	18	14	11	9.3	8.0	6.5	5.7	4.8	4.2	3.7	3.2	2.8	2.5	2.3	2.0	1.8	1.6	1.5	1.4	1.3	1.1
33	6154	1140	401	196	108	70	45	35	25	19	15	12	10	8.5	7.1	6.0	5.2	4.4	3.9	3.5	3.0	2.7	2.4	2.2	2.0	1.8	1.6	1.5	1.3	1.2
34	6475	1208	433	212	119	76	51	37	27	21	16	13	11	9.1	7.6	6.4	5.5	4.8	4.2	3.7	3.3	2.9	2.6	2.4	2.1	1.9	1.7	1.6	1.5	1.3
35	7075	1298	470	229	127	82	56	40	30	23	18	14	12	10	8.4	7.1	6.1	5.3	4.6	4.0	3.5	3.1	2.8	2.5	2.3	2.1	1.9	1.7	1.5	1.4
36	7788	1365	497	242	138	88	60	43	32	25	19	16	13	11	8.9	7.6	6.5	5.7	5.0	4.3	3.7	3.4	3.0	2.7	2.4	2.2	2.0	1.9	1.7	1.6
37	8245	1435	537	260	146	94	64	45	33	26	20	16	13	11	9.3	7.9	6.9	6.0	5.3	4.6	4.0	3.6	3.2	2.9	2.6	2.3	2.1	1.9	1.8	1.6
38	8715	1525	575	278	157	100	68	49	37	28	22	18	14	12	10	8.6	7.4	6.3	5.5	4.8	4.3	3.8	3.4	3.1	2.8	2.5	2.3	2.1	1.9	1.8

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The Batch Formula

To glass manufacturers who produce certain definite, standardized products, the question of the batch formula may appear rather unimportant. Usually this problem has been settled years ago. Very often the raw materials used are of such constant composition, and the margin of safety is so wide that no difficulty is encountered on that score.

The manufacturer, however, who does not produce a staple product but who fills orders as they come in, cannot dismiss the question of the batch formula from his mind so easily. His ware may have to meet certain specifications with regard to color, weight, condition of surface, composition, and others, depending on the use of the article. Such manufacturers should have a corner of the plant reserved for the purpose of doing experimental work on a semi-plant scale.

To make this suggestion would appear to recommend the obvious. Yet it is true that many of the smaller concerns, who can least afford to take chances have never gone beyond thinking about the matter. Apparently some have not even gone this far.

The result of this state of mind is that experiments are done anyway, only at a cost many times what a small experimental outfit would come to. By trying to make a short cut to success the result is that ninety times out of a hundred the longer road is travelled at a much higher expense than is necessary.

A manufacturer receives an order from a department store for a large amount of high grade table glassware of a certain color, with sample submitted. Is it wise to fill up a standard size pot with batch that will "probably" match the color? Or would it be better to fill up a monkey pot with a small amount of batch to see if the color really turns out as desired? The answer is obvious, and yet . . . !

To produce the proper kind of semi-opaque glassware for lighting purposes is certainly not an easy problem in glass making. It would seem absolutely necessary for factories receiving orders for such ware to have a few monkey pots sandwiched between the large ones for experimental purposes. What if too much cryolite or fluorspar is used and a new pot is ruined during the first attempt, with the loss of the pot and hundreds of pounds of valuable material?

Would such a loss pay for a small experimental plant? The answer is obvious, and yet . . . !

The batch formula is of even greater importance when glass is made in tanks. It is bad enough to lose a pot of glass. But to fill a tank with tons of glass that is not entirely satisfactory would seem to be little short of criminal negligence. This is especially so when automatic machinery is used.

There is one and only one best batch for each set of conditions and it should be the aim of the glassmaker to find that batch, and to experiment until it has been found. A batch which may be perfectly satisfactory under one set of conditions may give only indifferent results in another factory where conditions are dissimilar. Experimenting on a large scale is prohibitive in cost. Yet it is done, if unwillingly, resulting in cordy glass, excessive breakage, loss in production and quality to such a point that the cost of experimental work is spent many times over.

To ask some one to suggest a batch formula for a certain kind of glass is not fair to whoever gives the advice nor to him who receives it, unless it is thoroughly understood that a batch formula can at best only be an approximation, details to be worked out to suit manufacturing conditions. Refusal to recognize this results in many a disappointment.

Once a batch formula has been found to be satisfactory, one should have faith enough to stick to it. The tendency is too often to blame either the batch or the raw materials when trouble occurs. If a batch has given good results under normal conditions it is as sure as any other of nature's laws that it will do so again, provided conditions have not changed. It is patent that everything else should be considered as a possible source of trouble rather than to make a change in the batch formula which has proven to be correct. Yet the tendency is to lay the blame to the sand, or the lime, or the soda ash. One of the large manufacturers of soda ash has a glass technologist on his payroll for the definite purpose of proving to glassmakers that the soda ash is not to blame for whatever trouble occurs.

The conclusion is: experiment till the right batch is found. Then leave it alone and blame troubles on something else.

Technical Consultation Service

QUESTION 79.—BATCHES FOR OLIVE GREEN BOTTLE GLASS.—Please send me a lime glass batch for making olive green colored glass bottles. A great many bottles of this description are produced in foreign countries.

ANSWER.—There are two ways to produce an olive green color, namely: by the use of potassium bichromate and manganese or by the use of iron oxide and manganese. The potassium bichromate is decomposed by the melting process in such a way that the potash combines with the sand, while the chrome dissolves in the glass as the green oxide of chrome. The action of the manganese is to modify the color.

Another method is to utilize the green color due to iron oxide and to modify it with manganese. This, of course, is less expensive. The following batches are intended for hand-blown bottles. We give the batch composition and also the approximate chemical composition of the resulting glass:

1. Olive green glass, using chrome and manganese.

Batch:		Approximate composition of glass produced:	
Sand	100 lbs.		
Soda ash	33 "		
Burnt lime	15 "		
Potassium bichromate ($K_2Cr_2O_7$)	¾ lb.	Silica (SiO_2)	74.5%
Manganese (85% MnO_2)	¾ "	Sodium oxide (Na_2O)	14.3 "
		Lime (CaO)	11.2 "

2. Olive green glass, using iron oxide and manganese.

Batch:		Approximate composition of glass produced:	
Sand	100 lbs.		
Soda ash	32 "	Silica (SiO_2)	73.20%
Limestone	22 "	Sodium oxide (Na_2O)	13.60 "
Iron oxide (Fe_2O_3)	2¾ "	Lime (CaO)	9.50 "
Manganese (85% MnO_2)	2½ "	Iron oxide (Fe_2O_3)	2.00 "
		Manganese (MnO_2)	1.70 "

We assume that you desire to produce bottles with automatic machinery. In that case the batches given above would not be suitable, and it is advisable to use those batches which have been found by experience to be satisfactory in connection with machines.

The following batches are suggested:

I		II	
Sand	100 lbs.	Sand	100 lbs.
Soda ash	37-38 "	Soda ash	36-37 "
Limestone	17½-19 "	Limestone	17-18 "
Potassium bichromate	¾ "	Iron oxide	2¾ "
Manganese	¾ "	Manganese	2½ "

Assuming that 18 lbs. of limestone and 37 lbs. of soda ash are used to 100 lbs. of sand, the glass will have about the following composition:

Silica	73.1
Calcium oxide	7.3
Sodium oxide	15.8
Iron oxide	2.0
Manganese	1.8
	100.0

A glass of this composition will have a greenish yellow color in a pot and a strong green color in a tank, provided reducing conditions prevail in the tank.

These batches should not be considered as final but are merely standards that may be varied somewhat to obtain the desired viscosity, workability, etc., to suit the type of machinery used.

We strongly advise to test these batches on a small scale and not to fill up a tank with this material until you are thoroughly satisfied that you have the desired color and the properties suited to your equipment.

The sand and limestone need not be pure, but it is advisable to know their composition.

European glassmakers use blast furnace slag, basalt, phonolith, feldspar and a large amount of limestone in order to save on soda ash. The composition of some of these glasses makes them quite unsuitable for automatic machinery. The following analyses may convey an idea as to the composition of French bottle glasses:

	Cognac	Bordeaux	Champagne
Silica (SiO_2)	62.54%	61.75%	61.90%
Alumina (Al_2O_3)	4.42	7.10	4.44
Iron oxide (Fe_2O_3)	1.34	2.70	1.85
Lime (CaO)	20.47	19.60	17.95
Magnesia (MgO)	5.41	4.55	6.18
Sodium oxide (Na_2O)	4.73	4.10	6.16
Manganese oxide (MnO)	4.73	0.11	6.16
Potash (K_2O)	0.94	0.11	1.13
Sulphate (SO_3)	0.10	0.09	0.17

The use of such glass as cullet, in connection with batches suitable for automatic or semi-automatic machinery is, of course, not to be recommended. We know of cases where cullet from imported wine and champagne bottles has been used (in South America and Australia) in connection with the usual American machine glass batches and where it has caused a great deal of difficulty.—J. B. K.

QUESTION 80.—PROCESS OF MAKING GLASS IRIDESCENT BY SPRAYING LIQUID. Would you kindly inform me if you are in a position to do so, the process of making glass iridescent by spraying liquid on same while the glass article is in an almost plastic state. This process gives a deep golden effect.

ANSWER: We understand that there are two processes for producing iridescence on glass by means of a liquid spraying process. In the first one an aqueous solution of tin chloride and iron chloride is sprayed through a rubber sprayer directly on the glassware after it has been pressed in the mold and while it is still hot. The concentration of this solution is one part of tin chloride and eight parts of ferric chloride dissolved in sixteen parts of water. A different effect is obtained by using a mixture of iron chloride, tin chloride and strontium nitrate in dilute hydrochloric acid solution. The solution can be obtained from dealers in ceramic materials.

The second process is the spraying or painting on cold glass, of prepared lustres which, after drying, are run through the decorating lehr and fired, obtaining the lustre in the firing. These prepared lustres consist of resinates of various metals mixed and dissolved in suitable organic solvents. There is considerable literature available on these resinates but we understand that it is cheaper to buy a prepared lustre than to make it. Besides better results are obtained with the prepared mixtures.

It should be understood that these directions are only of general nature and that a considerable amount of experimental work must be done in order to get the desired results.

CULLET PILE PHILOSOPHY

By SILICA SAM

All Work and No Play, Etc.

Play has its place in connection with an industrial plant as well as it has in our schools. It invigorates the mind and body of the worker as well as of the student.

Labor troubles are usually unknown at plants where the spirit of the game has entered in and taken possession. The good natured competition between departments in athletics may be carried over into the daily tasks with beneficial results.

A huge outlay for equipment is unnecessary and foolish. A baseball field and necessary equipment, horseshoe courts and shoes and a modest gymnasium equipped for basketball, boxing and dancing is all that is necessary and wise. A policy of hands off as far as possible should be adopted by the management. Of course, there needs must be schedules, rules and regulations governing the use of this layout but these can best be placed in the hands of a sports and social committee, a member elected from each department. Interdepartmental games should be especially encouraged. After the original kick-off, the management should retain only the power of veto in connection with these things and use it as seldom as possible.

"Professionalism" will have to be guarded against as the chief danger to the success of this idea. By "professionalism," we refer to the tendency of star players to rely upon their skill at the game or games to hold their jobs for them and the tendency of foremen who are deeply interested in their teams' success to let this very thing happen. For this reason, the athletic organization and plant organization must be kept entirely distinct. It is, also, best to require a year's service for eligibility to represent the plant or a department on an athletic team. The "professional" athletes won't stick that long.

The greatest benefit lies not in developing a few star athletes but in getting unanimous participation and interest. If this can be done, the benefits are worth while dividends on the investment. An outfit that can play or can learn to play together in good spirit will work together in the same spirit.

Usually the people who will let an idea such as that they get the worst of everything keep preying on their mind, find relief in that the idea will starve.

Talk Instead of Walk

The real plant executive finds it absolutely necessary to spend most of his time out in the plant. Frequently during the time he is out there, he will be wanted on the telephone, at the office or by the head of some department other than the one he may be in. His time is very valuable and so is that of the man who wants to speak to him and who does not just know where to find him right then.

Oftimes, foremen of different departments need to speak to each other or one wants to see the other to show him something but must waste time to hunt him up. The executive may want to call one or two or three foremen to the office for a conference. He may only want to ask one about a matter that he is writing a letter about. The timekeeper may want to ask a foreman about a man's time. The storekeeper may want the master mechanic to come to the storeroom to look at some apparently inferior supplies that just came in—and so on, indefinitely, along that line.

The money wasted in most plants in the time and energy of "high priced men" spent running around in circles trying to get along without a call and communication system would pay for the best of such systems in a surprisingly short time.

The best is an automatic telephone system, independent, within the plant, with an auto call in connection. We've seen them but don't know who makes the bloomin' things,—so we're not advertising. Maybe, the combination was home grown. Anyway, it looked mighty good to Sam and sure saved time and shoe leather for the men whose time was valuable. If prices in that town equal ours, their shoe leather was darn valuable, too.

Wise men make the lessons of the past their servants of the present.

Competition

No form of economic organization has produced results comparable to competition, in which the individual is given opportunity to express himself and succeed or suffer the consequences of his follies. Competition is harsh, sometimes cruel, but it works. It gets results.

Can this be carried into the organization and made to get good results? Silica Sam argues that it can be used to particularly good results in a glass plant. A statement each week to the shift operators on each producing unit showing their relative standing for the previous week as regards pack and cullet loss becomes the "*score*" sheet in a most interesting competitive game.

Comments on the "score" by the executive lends interest. These should take the form of "pats on the back" for the leaders and encouragement for the followers. Sometimes, advice may be appropriate. But censure should be given verbally and privately. A summary at the end of the year will lend to keenness and value of the competition for top place in the list.

We don't always get what we go after but think of all the things we get without even a thought of going after them. Furthermore, a lot of fellows "get" us by coming after us and sometimes they don't.

Interesting the Foremen and Men in Costs

Have you a little Scot in your plant? If you have, he can save you a lot of money, if you'll give him a chance.

Departmental cost sheets going out to the foremen of the departments and through them to the men can be a scandalous waste of paper. But if they're given a gauge or budget to measure themselves against these cost sheets may be very, very valuable to them and you. This can be obtained and set fairly by taking an extra good month or period and averaging its costs with those of an average period. Then the current cost sheets going out should show beside the cost totals the difference between it and the "budget"—in black if less and in red if more.

Here's where the Scot comes in,—After the first month or two there'll be no red on his cost sheet and he'll begin increasing the amounts in black and he'll also begin telling and showing the rest of the bunch. Then we'll have some more of this wonderful *Competition* we've been talking about and the results of it will go into the profits.

Getting even isn't half as profitable as getting ahead.

Looking Ourselves in the Face

Masses build up theories of exploitation and oppression to account for their inferior status. Classes of accidental good fortune theorize on superior inheritance and worth to justify their continuance in non-productive parasitism. Cowards salve their humiliation by attributing to themselves dignity or sensibility. Cruel men imagine themselves especially virile. Facing our faults and straight thinking on the part of each will help us all to eliminate or minimize our faults and make winning teams of our organizations.

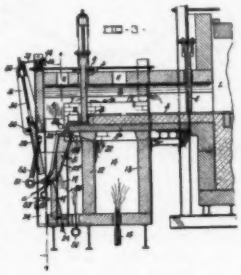
The least one should be satisfied to do in the world is the greatest and most his talents make possible.

Recent Patents

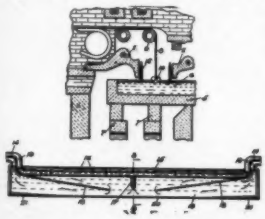
NEW INVENTIONS DESIGNED TO IMPROVE GLASS AND THE MEANS OF PRODUCING IT

Complete copies of U. S. Patent Specifications may be obtained from the Commissioner of Patents, Washington, D. C. Price 10c each

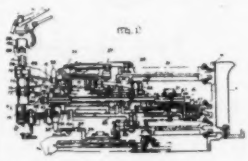
METHOD AND APPARATUS FOR MAKING SHEET GLASS. U. S. 1,555,358. Sept. 29, 1925. Edward Danner, Toledo, O. Filed 7/14/20. Relates to improvements in former patents 1,261,366 and 1,261,367. The object is to form sheet glass in such a manner as to prevent the forming of streaks and lines on the under side of the sheet as it passes over a trough, slab or lip. This is accomplished by causing the molten glass to flow down the flattening means in split form for at least a portion of its length so that a glass film is provided at both sides of at least the tip or discharge end portion of the slab from which the glass flows, and causing a merging or uniting of the separate films into a single sheet at the drawing or flowing off point, whereby the surfaces of the films having contact with the tip at the point of flowing off are united interiorly of the sheet and both outer surfaces thereof have the desired smooth fire finish.



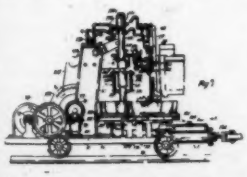
COOLER FOR SHEET-GLASS APPARATUS. U. S. 1,554,994. Sept. 29, 1925. Enoch T. Ferngren, Toledo, O., assignor to the Libbey-Owens Sheet Glass Co. Filed 12/3/24. Means for drawing a sheet of glass from a mass of molten glass, means for lowering the temperature of the surface glass thereof before it is drawn into the sheet, including means for introducing a cooling medium in proximity to and centrally of the said glass, and allowing the cooling medium to pass from the center toward both sides of said mass of molten glass in such a manner that the coolest portion of the cooler will be at the center thereof, while the border portions will be relatively higher in temperature.



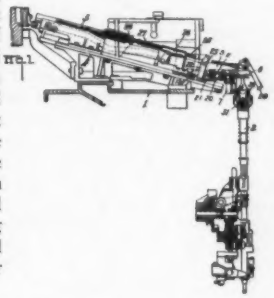
GLASS-BLOWING-SPINDLE APPARATUS. U. S. 1,555,216. Sept. 29, 1925. August Kadow, Alvah C. Parker and Carl W. Schreiber, Toledo, O., assignor to the Libbey Glass Manufacturing Co. Filed 1/26/24. This invention has for its object to shorten the spindle, reduce the space occupied by its operating mechanism, and generally to reduce the weight, size and operating force required by this mechanism. Also to so construct the parts that a spindle carrying yoke may be readily removed from the machine, and to arrange the parts so that the packing gland about the air pipe within the spindle will be easily accessible, and will be distant from the glass carrying end. Also to so arrange the parts as to avoid the necessity for thrust bearings within the spindle.



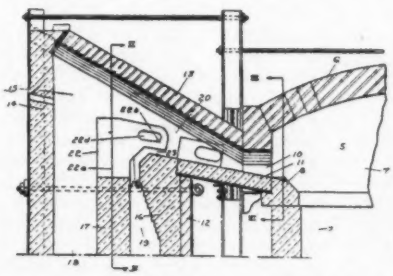
GLASS-MOLDING MACHINE. U. S. 1,555,897. Oct. 6, 1925. Samuel Este Winder and Henry Cotton Daubenspeck, London, England. Filed 10/4/20. In a glass-working machine, the combination with a series of molds and means for bringing the same successively into pressing position, a pressing plunger adapted to cooperate successively with said molds, a reciprocating cross-head, a cylinder-and-piston connection between the cross head and plunger, and means for supplying light compressible fluid pressure exceeding atmospheric between the cylinder and piston.



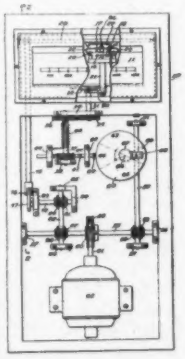
METHOD AND APPARATUS FOR FORMING GLASS STEMWARE. U. S. 1,555,215. Sept. 29, 1925. August Kadow, Toledo, O., assignor to the Libbey Glass Manufacturing Co. Filed 11/10/22. The object is to simplify the manufacture of stemware by forming the foot and stem portions thereof complete in the gathering mold or head and subsequently developing the blank portion at the outer end of the stem to form the bowl of the article. The process consists in sucking glass into a mold and thereby forming a blank having the stem in final shape and bowl in unexpanded form, and thereafter expanding the bowl portion.



GAS BURNER. U. S. 1,554,831. Sept. 22, 1925. Walter O. Amsler, Pittsburgh, Pa. Filed 8/7/22. A burner construction for furnaces comprising an air passage, a vertical gas passage, a vertical wall within the burner, and means resting on said wall and projecting in lateral direction beyond said wall across the top of the gas passage to form a partition between the air and gas passages inside the burner structure at the point of juncture of said passages.

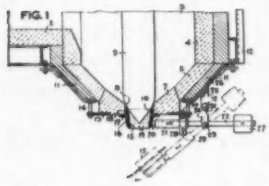


FURNACE REGULATING SYSTEM. U. S. 1,555,549. Sept. 29, 1925. Richard P. Brown, Philadelphia, Pa., assignor to the Brown Instrument Co. Filed 8/17/21. Some of the objects are to provide means for regulating or controlling a heating medium in accordance with a predetermined characteristic temperature curve; to provide means for causing a heating medium to operate in such a manner as to conform to a predetermined heating cycle; to provide means for automatically varying the heating cycle in a predetermined manner; to provide an electrical instrument arranged to cause a heating medium to maintain a constant temperature for a certain time interval; to provide an electrical instrument arranged to increase the temperature of a heating medium to a selected maximum and then maintain such maximum temperature for a certain time interval; to provide an electrical instrument arranged to gradually decrease the temperature of a heating medium in a predetermined manner; to provide means operating in conjunction with a movable element of an electrical instrument whereby a circuit corresponding to a certain temperature is caused to function; to provide means operating in conjunction with an electrical instrument for causing a controllable device to function in accordance with a predetermined characteristic condition or quantity curve.



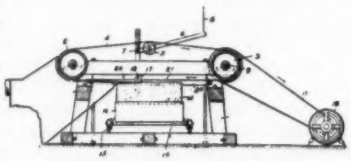
REENFORCED GLASS. U. S. 1,556,364. Oct. 6, 1925. John C. Smith, Chicago, Ill., assignor to Solar Electric Company. Filed 3/31/23. A reenforced glass having a plurality of short wires, asbestos fibres, or other suitable material arranged in a haphazard manner and embedded in the glass in overlapping relation.

METHOD AND APPARATUS FOR CASTING PLATE GLASS. U. S. 1,556,381. Oct. 6, 1925. Frank E. Troutman and Charles H. Christie, Butler, Pa. Filed 4/13/22.



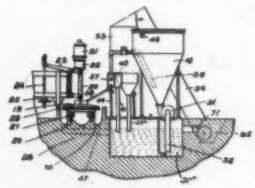
The method of casting plate glass that comprises flowing the glass through a downwardly opening outlet in a receptacle, checking the descent of the sides of the issuing glass and causing a portion of said glass to form a discharge throat, and discharging another portion of glass through the said glass-lined discharge throat upon a casting table.

APPARATUS FOR DRESSING CLAY BLOCKS. U. S. 1,554,925. Sept. 22, 1925. Lee Showers, Charleroi, Pa., assignor to Pittsburgh Plate Glass Co. Filed 6/5/23.



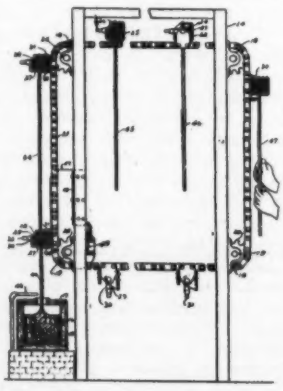
Apparatus for dressing clay blocks comprising an abrading belt, a pulley for driving the belt, means for supporting a block with the surface to be dressed in opposition to the abrading surface of the belt, and a presser member of circular cross section having a diameter less than one-half that of said pulley mounted for rotation back of the belt and extending transversely thereof in opposition to the block.

GRINDING APPARATUS FOR PLATE GLASS. U. S. 1,556,730. Oct. 13, 1925. Jacob Soderberg, Pittsburgh, Pa., assignor to Pittsburgh Plate Glass Co. Filed 7/28/23.



In combination in grinding apparatus, a series of sets of grinding machines, means for carrying sheet glass continuously beneath the series of machines, a series of grading tanks, one for each set of machines, means for causing an upward flow of liquid through each of the tanks to grade the abrasive therein, means for supplying the graded abrasive from each tank to its set of grinding machines, means for supplying the used abrasive and water from each set of machines (except the last set) to the grading tank for the next succeeding set, and means for returning the used abrasive and water from the last set of machines to the grading tank for the first set.

CONTINUOUS-GLASS-DRAWING DEVICE. U. S. 1,554,547. Sept. 22, 1925. Hector Bazin and Arsene Boyle, Detroit, Mich. Filed 10/12/23.

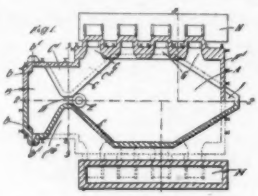


A glass sheet drawing machine, provided with endless carriers, a frame for supporting the said endless carriers, bearing brackets suitably attached to the said endless carriers, a glass sheet clamping device adapted to swivel in the said bearing brackets, and blocks attached to the said frame, the said blocks contacting with and guiding the said glass sheet clamping device to a position adjacent the glass sheet without deflecting the said glass sheet from its drawing position.

Other objects of the invention will be found in specifications.

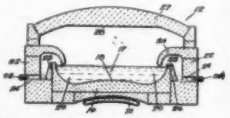
METALLIC MOLD FOR FORMING GLASS ARTICLES AND METHOD OF MAKING SAME. U. S. 1,556,925. Oct. 13, 1925. Fred J. Frink, Lancaster, O., and Robert L. Frink, London, England. Filed 3/31/22. The method of making a mold for glass, which consists in shaping such mold from an aluminum calcium alloy, then subjecting the surface thereof to the action of an alkali metal hydroxide in solution, whereby such surface is given a vascular or finely pitted character, so that the interior surface of the mold allows absorption of gases or liquids to take place for some depth into the body, and eliminates the necessity of using graphite paste or other mixtures on the surface of the mold.

GLASS-MELTING FURNACE. U. S. 1,557,078. Oct. 13, 1925. Thomas Courtney Moorshead, of Strand, London, England, assignor of one-half to the United Glass Bottle Manufacturers, Ltd. Filed 10/15/24.



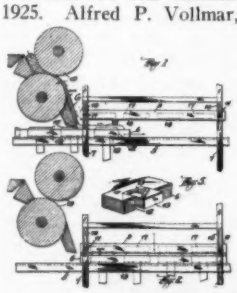
A glass melting tank furnace comprising a melting compartment, a working compartment, a bridge wall the sides of which are so disposed relatively to both the working and melting compartments as to avoid right angled corners in which dormant glass can collect, and the other boundary walls of said melting compartment being also so formed as to avoid right angled corners.

SHEET-GLASS APPARATUS. U. S. 1,557,148. Oct. 13, 1925. Enoch T. Ferngren, Toledo, O., Assignor to the Libbey-Owens Sheet Glass Co. Filed 12/26/24.



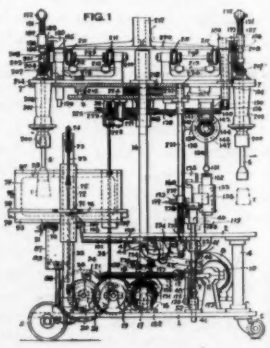
An object of the invention is to provide a method for producing sheet glass wherein a stream of molten glass is flowed through a cooling chamber and into a draw-pot, the cooling chamber and draw-pot having means associated with the border portions for directing heat upon the border portions of the molten glass to raise the temperature thereof so that the central flow of glass and border portion of the glass will be substantially uniform, and having the inner bottom surface of the chamber curved upwardly along the longitudinal axis, whereby to decrease the depth of the pot at the center and gradually increase the depth thereof toward the border portions where said cooling chamber and draw-pot is deepest.

APPARATUS FOR MOLDING GLASS. U. S. 1,557,504. Oct. 13, 1925. Alfred P. Vollmar, Forest Hills, N. Y., assignor to the Paul Wissmach Glass Co., Inc. Filed 8/27/21.



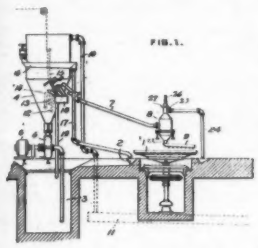
For the molding of letters, numerals or other ornamental forms or characters in glass plates. As the plastic sheet of glass is fed to the table 6 this table is progressively moved in the frame 5 as shown by the arrows in Fig. 1 until the table is disposed entirely beneath the frame 9, at which time the feeding of the glass is discontinued. The frame 9 is now lowered and together with the die member 17 thereby exerts a compressing pressure upon the plastic sheet.

MACHINE FOR FIRE-POLISHING AND FINISHING GLASSWARE. U. S. 1,554,038. Sept. 15, 1925. A. J. Sanford and J. B. Townsend, Newark, O., assignors to A. H. Heisey & Co. Filed 8/30/21.

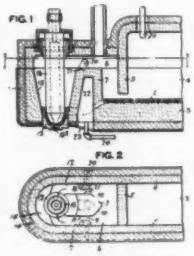


The machine consists in general of a carrier which rotates in a step-by-step manner. Three glory holes are carried on a single support which is raised and lowered at each step of the frame at the proper time to enclose the ware in the glory holes. The punties carrying the ware are advanced horizontally from the sticking-up position to the knocking-off position, passing the glory hole and finishing positions without being moved vertically. The punties carrying the ware are rotated while they are in the glory hole positions and are rotated at a higher speed while in the finishing position.

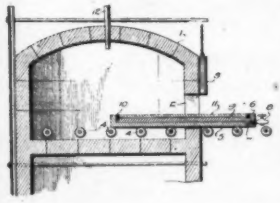
PROCESS AND APPARATUS FOR APPLYING ABRASIVE TO GRINDING APPARATUS. U. S. 1,556,753. Oct. 13, 1925. Christopher Brown, Charleroi, Pa., assignor to Pittsburgh Plate Glass Co. Filed 2/9/23. The process of applying abrasive to a grinding machine, which consists in collecting the abrasive and water from the machine, returning the mixture to a grader and separating the abrasive into a series of grades, withdrawing therefrom first the coarsest grade of abrasive mixed with water, and causing the mixture so withdrawn to flow to the machine by gravity and during such flow concentrating the mixture by a settling operation, but without removing the abrasive from suspension.



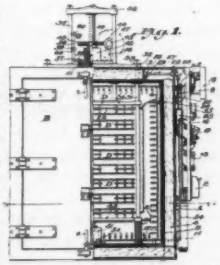
FEEDING MOLTEN GLASS. U. S. 1,553,819. Sept. 15, 1925. George E. Howard, Butler, Pa., assignor to Hartford-Empire Co. Filed 4/4/23. In feeders of the plunger type, the plunger, by intercepting the hot gases and the heat radiated from the furnace or forehearth, causes what may aptly be called "a cold shadow" on its front side farthest away from the furnace, tending to chill the glass on that side. This invention avoids the resulting difficulties by bringing the fresh hot glass from the furnace to the discharge outlet in two or more streams of substantially equal temperature, which approach the outlet from different directions and are combined at the outlet.



METHOD OF MAKING PLATE GLASS. U. S. 1,553,773. Sept. 15, 1925. Wm. E. Heal, Dist. of Columbia. Filed 9/6/24. The method of making glass plates which consists in placing a layer of powdered glass on the upper surface of a substantially horizontal supporting medium, such as a layer of metal, preferably tin, having a lower fusing point than that of the glass, heating the glass and supporting medium to a temperature at least as high as the fusing point of the glass, cooling the glass to a point below its fusing temperature but above the fusing temperature of the supporting medium, and removing said supporting medium from beneath the glass in a fluid condition.

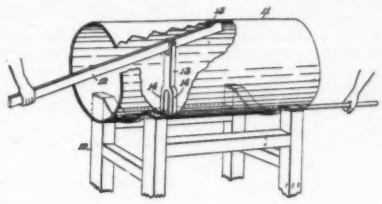


APPARATUS FOR FABRICATING REENFORCED GLASS. U. S. 1,553,667. Sept. 15, 1925. Wm. Bull, Brooklyn, N. Y. Filed 6/26/25. This relates to a novel apparatus for fabricating laminated or reenforced non-shatterable and scatterless glass, composed of sheets of plate glass united by and reenforced with transparent cellulose material, pyrolin, viscose, and casein, or equivalent materials. It includes a novel electric oven readily accessible through doors opening at one side, and which contains a novel multiple press device adapted to operate on a plurality of glass units to be treated, which after the completion of the cementing or uniting period may be properly cooled and removed with facility.



GLASS-DRAWING APPARATUS. U. S. 1,556,726. Oct. 13, 1925. Harry G. Slingluff, Mt. Vernon, O., assignor to Pittsburgh Plate Glass Co. Filed 2/26/23. An improvement to apparatus for drawing sheet glass from a tank. Relates primarily to a shaped guiding bar located beneath the line of generation of the sheet and has for its object to produce a sheet of very uniform thickness from edge to edge.

SPLITTING JACK FOR GLASS CYLINDERS. U. S. 1,557,528. Oct. 13, 1925. Joe H. Howard, Okmulgee, Okla. Assignor of one-fourth to each of Baker Brothers Glass Co., Harding Glass Co., National Glass Co., and Wichita Falls Glass Co. Filed 3/11/25. A splitting jack for glass cylinders comprising a standard having laterally separated feet, and a lever articulated with the standard upon an axis transverse to the length of the lever, said lever having one end adapted to engage the upper interior of the glass cylinder and the other end adapted to be engaged by the hand of an operator.



Horak Resistant Glass

The process of making Horak's resistant glass, a product which has frequently been mentioned in the technical and daily press during the past year or two has been protected in the United States by Patent No. 1,557,540, issued to Václav Horak of Vinshrady, Prague, Czechoslovakia. The application was filed at Washington on January 22, 1923. The inventor claims that this glass is of a highly resistant character and that it can be produced as easily as a glass with basis of silicious sand, and on the other hand possesses physical and chemical qualities superior to products of fusion of quartz.

The process consists in submitting, in a furnace to a temperature of about 1200° centigrade, a mixture of sand, boric acid, carbonate of potash, carbonate of soda, kaolin, mica, zirconic and titanic oxides.

The proportions of materials in this composition may vary within considerable limits without the products that result therefrom differing substantially in their characteristic properties. The most usually employed proportions may be summarized as follows:

	Percent
Sand (Hohenbocka mark)	60 to 70
Anhydrous boric acid	15 to 30
Potassium carbonate	1 to 2
Sodium carbonate	3 to 6
Kaolin (hydrated silicate of aluminum)	2 to 6
Mica (muscovite)	1 to 4
Zirconic acid	1 to 3
Titanic acid	1 to 3

By way of example, the composition by weight of a glass in accordance with the invention is as follows:

Sand (Hohenbocka mark)	91 kg. 500
Boric acid	31 kg. 760
Potassium carbonate	1 kg. 850
Calcined sodium carbonate (Solvay mark)	6 kg. 700
Kaolin (very dry)	5 kg. 600
Mica (muscovite)	3 kg. 600
Zirconic oxide	2 kg. 320
Titanic Oxide	2 kg. 590

The proportions of the efficacious oxides in this composition are as follows:

	Percent
SiO_2	66.38
B_2O_3	22.85
K_2O	1.61
Na_2O	2.70
Al_2O_3	2.35
ZrO_2	2.31
TiO_2	1.80
	100.00

These materials finely ground and mixed are heated in an ordinary furnace, the mixture melts at a temperature of about 1200° centigrade, and the melted bulk is blown or moulded as easily as ordinary glass.

Analysis of this glass has given this formula:

SiO_2	65.05
B_2O_3	23.43
Na_2O	2.80
K_2O	2.55
Al_2O_3	2.35
ZrO_2	2.20
TiO_2	1.62

This formula supposes that the materials employed are as chemically pure as can be found in commerce. For instance, Hohenbocka sand is used which contains 99.7% SiO_2, calcined potassium carbonate (or calcined potash) having 98% K_2CO_3, calcined sodium carbonate (Solvay) having 100% Na_2CO_3, very dry Kaolin (hydrated silicate of alumina) muscovite in dry powder, and zirconia and titanic oxides.

The cubical coefficient of expansion of the glass is 143 to 145 x 10^7.

The glass is a good conductor of heat. It is said it can support a sudden fall of temperature from 320° to 0° centigrade.

It is a very good electrical insulator. It is claimed to possess greater resistance to acids and alkalies than known laboratory glasses and very great resistance to shock. The melted material can be drawn and blown very easily and is particularly suitable for the manufacture of bulbs for serums. It can be heated a very long time without devitrifying.

If a vessel is cracked owing to a blow, it will suffice to heat the crack direct on a gas burner for every trace thereof to disappear. By tapping or knocking the vessel a sound is produced that distinguishes the product without difficulty from similar products of different composition.

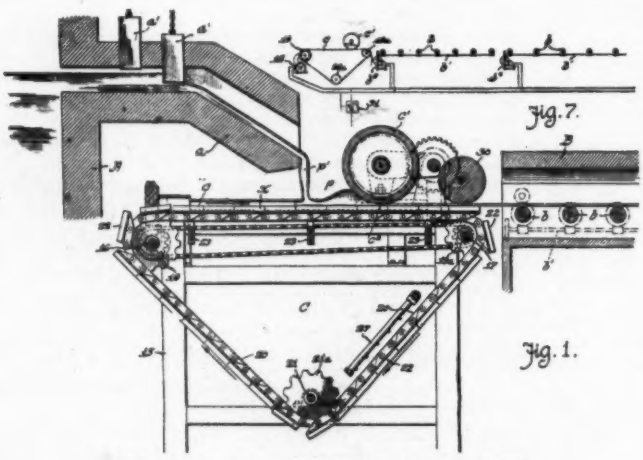
Tin soldering melted in a vessel made of this glass does not adhere to the vessel after cooling and consequently can be withdrawn without the slightest difficulty.

The glass is particularly suitable for making laboratory vessels and apparatus as it does not contain barium, zinc, arsenic, antimony or any element that could mix with a solution. It is also suitable owing to the same reasons, for making cooking utensils and glassware for medical purposes.

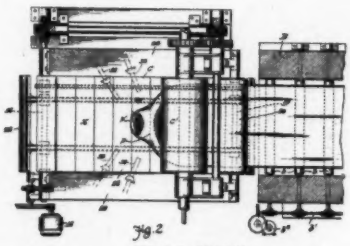
Patents Issued on Ford Motor Company's Process

A patent (No. 1,556,665) issued by the United States Patent Office on October 13, 1925 covers the "Art of Producing Continuous Sheet Glass" which has been in successful commercial operation at the Ford Motor Company's plants at Highland Park, Detroit, and River Rouge, Mich., for a considerable length of time. The inventors of the process and the patentees are Clarence W. Avery and Edward T. Brown, who assigned the patent to the Ford company. The specifications disclose some interesting details of the process hitherto not published. Claim No. 1 reads as follows:

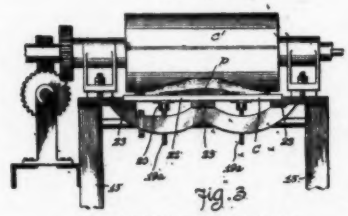
> In the art of producing continuous sheet glass, the method of forming the sheet which consists in establishing an unconfined pool of the molten metal on a flat traveling surface in advance of and leading to a forming pass with the pass dimension substantially equal to the thickness of the sheet and greater than the width of the sheet, and continually passing metal from the pool through the pass to form the sheet, whereby the unconfined characteristic of the pool will be maintained within the pass with respect to the sheet edges, the pool characteristic being maintained by a continuous supply of metal thereto, the width of the sheet being produced by the natural flow of metal within the pool."



SECTIONAL VIEW THROUGH FLOW SPOUT



PLAN VIEW



TRANSVERSE SECTION

As a concrete illustration of the characteristics of the invention the specifications state that one of the installations in active service produces continuous sheets which as the sheet emerges from the lehr is cut into the proper lengths and then subjected to the grinding and polishing action to produce the finished product. The installation produces finished sheets of one-fourth inch thickness, the sheet, however, being formed of a thickness of three-eighth inch—as compared to the one-half inch of the usual casting process—thus setting up a saving of 25% in the amount of material employed in the production of sheets of equal length and width as between the installation and the usual casting process, and a saving in the time and labor in the grinding and polishing, due to the fact that only 50% of the sheet is wasted by grinding and polishing as compared with the 100% amount of the casting process, the percentages being on the basis of the thickness of the finished product, the waste in the usual casting process being equal in thickness to that of the final product.

In the installation referred to the melting and refining chamber have a capacity of approximately sixteen tons of molten metal every 24 hours, the discharge spout having an active width of flowing metal of approximately eight inches. The melting chamber is charged with the raw materials at regular intervals and in amounts such as to maintain the content between approximate and minimum amount limits.

The lehr is in excess of four hundred and fifty feet in length, and its entrance is spaced less than ten feet—the distance is about five and a half feet—from the discharge end of the spout from the refining chamber. The lehr supports the sheet on rollers, positively driven at speeds such as to prevent any piling up of the sheet within the leer under normal operation, the rollers being arranged in series of units with the unit spacing differing in a gradually increasing distance ratio.

The constancy of the pool dimensions is made apparent through the fact that the table surface appears to be moving steadily forward beneath the pool with the latter appearing to remain stationary.

And in this is to be found one of the principal characteristics of the present invention. The metal is delivered to the table and then permitted to flow gently and non-forcibly into its approximate sheet formation, the mouth of the pass serving to restrain forward movement of the entire pool during motion of the table, so that there is formed an increased thickness of pool as the mouth is approached and reached, thus slightly increasing the effect of gravity and increasing the flow laterally accordingly, but the flow is the natural flow of the metal, with the result that the molecules and particles of the metal arrange themselves in a natural way relative to each other, the treatment not forcing any particular and definite arrangement, but permitting a free and natural flow.

Glass Factory Equipment and Supplies

Most of the information printed in this department comes direct from the manufacturers of the products described.

A Pyrometer Improvement Directly Affecting Product

A majority of recent improvements in indicating and recording pyrometers have perhaps had little effect on the product being heated, for the new designs have brought about mainly added convenience to the operator, better mechanical construction and mechanical dependability and similar advantages.

An improvement pertaining to actual accuracy of temperature measurement, and therefore directly affecting the product heated

MULTIPLE RECORD RECORDING PYROMETER WITH AUTOMATIC ELECTRIC COMPENSATOR

is the new automatic electric cold junction compensator manufactured by Wilson-Maeulen Company, 385 Concord Avenue, New York.

By this equipment the temperature fluctuations of thermocouple cold junctions are now compensated electrically, and thermostats, water-cooled cold junctions, buried cold junction wells, and similar arrangements for stabilizing cold junction temperatures are now unnecessary.

Outdoor location, underground flues, and other conditions common in ceramic plants have at times made it difficult to maintain cold junction temperatures constant to avoid errors.

The Wilson-Maeulen automatic electric compensator now compensates accurately for changes of thermocouple cold junction temperature, correcting electrically the thermocouple voltage.

This compensator employs a wheatstone bridge in the thermocouple circuit. Three sections of this bridge are resistances composed of materials of constant resistance and the fourth section is of material which alters in resistance in response to temperature changes, thus altering the current from a dry cell connected to the wheatstone bridge.

This temperature responsive coil and the thermocouple cold junction are both located at the instrument panel where both are subject to the same temperature changes.

This method electrically corrects the thermocouple voltage, entirely independent of the instrument, and does not involve any mechanical or electrical movement or correction inside the instrument.

For this reason it permits more convenient checking of instruments.

The high order of accuracy of compensation attained by this compensator is based on the great precision with which the resistances composing the compensator can be commercially manufactured and on the exactitude of resistance changes (and therefore current corrections) in response to temperature change.

Instruments of various ranges, if for the same type of thermocouple, can be interchanged on the same compensator, and it can be applied to double range instruments, by using two compensators, one for each range.

When indicating and recording pyrometers are used in combination, one automatic electric compensator is sufficient for both indicator and recorder, since the correction is made in the thermocouple current, and not in the instrument.

Installation of pyrometer equipment is greatly simplified, for the wiring and connection of the compensator is done on the instrument panel at the factory, and the user has only to run a pair of extension leads from each thermocouple to his instrument panel and make connections there.

In installing equipment the user need not be concerned with theories of compensation or ways and means of stabilizing the temperature of the cold junction.

INDICATING PYROMETER WITH AUTOMATIC ELECTRIC COMPENSATOR

This equipment has been thoroughly tried and has been in use for some time and practically all the pyrometer equipment now being installed by Wilson-Maeulen Company is equipped with this type of compensator.

An attractive booklet—No. P-110—illustrating and describing this equipment, is ready for distribution and will be mailed on request by Wilson-Maeulen Company, 385 Concord Ave., New York.

In the investigations that are being made with a view to reforming the system generally in vogue in New York City in estimating the cost of building construction by general contractors the fact has been developed that building projectors in the five boroughs of New York City so far this year have paid out for unnecessary waste, $9,000,000, representing estimating cost that could easily have been saved if better merchandising principles had been followed in determining the final price of a building construction project. It costs $2,000 for estimating the cost of every million dollars worth of projected building construction. The average number of contractors who figure a building operation of this size is six. Therefore, on a million dollar apartment house operation, $12,000 is spent on finding out how much the owner or projector will have to pay for erecting the proposed building

The Glass World and What It Is Doing

News of the Industry

Protest Misrepresentations of Window Glass Quality

In line with the efforts being made by structural steel and electrical contractors and building material dealers to eliminate time worn practices and policies that tend to keep building construction costs and maintenance high, the glass industry joins the movement with a protest against public deception, writes Allen E. Beals in Dow Service Daily Building Reports.

Through a new process of manufacture a drawn window glass is produced, heavier than the ordinary thickness. The thickest this glass is made in this country is 3/16 inches, but European manufacturers are making it a scant ¼ inch in thickness, and, upon being imported into this country, it is being sold in certain sections of the trade as polished plate glass.

Speculative builders who sell their buildings before they are completed are the principal outlet for this kind of glass, the purchaser believing until too late, that he has genuine plate glass show windows. The situation has reached a point where organized efforts to stamp out loss to unsuspecting building investors in this way has been undertaken by the National Better Business Bureau, Inc., a part of the work of the Associated Advertising Clubs of the World.

Response to invitations to report cases of misrepresentation of this character has been so great that they include not only purchasers of finished buildings, but buyers of doors, windows, store fronts, show cases, desk tops, automobile windshield replacements, etc., although they have in many cases paid for this glass the full purchase price of real plate glass.

"Plate glass," according to the official U. S. Government Master Specifications for flat glass for glazing purposes, "is transparent, flat, relatively thin glass having plane polished surfaces and showing no distortion of vision when viewing objects through it."

"Clear window glass," according to the same Master Specifications, "is transparent, relatively thin, flat glass, having glossy, fire finished apparently plane and smooth surfaces, but having a characteristic waviness of surface which is visible when viewed at an acute angle or by reflected light, the surface finish being that obtained during the drawing process."

"The material now coming into the market against the protest of the domestic glass manufacturing interests rates as window glass in the U. S. Customs," according to the National Better Business Bureau, Inc., of 383 Madison Avenue, New York, and while thicker than ordinary window glass, it does not possess the well known characteristics of plate glass. Apparently it is being sold to the trade by the importers as and for ¼ inch window glass, the misrepresentation and confusion being the work of some unscrupulous contractors and sub-contractors. "This glass," the Bureau says, "has merit where window glass is the desired material; but advertising or selling it as and for plate glass is deceptive and misleading."

Some of the companies that insure plate glass store fronts have declined to issue policies covering windows glazed with other materials than genuine plate glass, and for the guidance of the public it explains how the purchaser may make sure that when he pays for plate glass he gets plate glass. Look through the glass in question at an angle of 45 degrees. Images of straight line or other objects will be free from distortion when so viewed through genuine plate glass. The wavy surface of window glass, however, may be readily detected under this test.

Building Construction Continues to Boom

The largest September building record and the second largest month on record, is the F. W. Dodge Corporation's report for construction work started that month. Building and engineering contracts awarded in the 36 eastern states (which include about seven-eighths of the total construction volume of the country) amounted to $548,216,700. This was only 7 per cent under the high record figure of August, and it represented a 59 per cent increase over September of last year. A seasonal decline of about 7 per cent is customary in September.

The month's record included the following important items: $250,417,000, or 46 per cent of all construction, for residential buildings; $80,171,800, or 15 per cent, for commercial buildings; $79,668,000, or 15 per cent, for public works and utilities; $43,297,700, or 8 per cent, for industrial buildings; and $35,217,300, or 6 per cent, for educational buildings.

In three big districts the construction volume of the past nine months has already exceeded the total construction volume of last year. These districts are New England, Pittsburgh District (Western Pennsylvania, West Virginia, Ohio and Kentucky) and the Central West (Illinois, Indiana, Iowa, Wisconsin, Michigan, Missouri, Kansas, Oklahoma and Nebraska). In the entire 36 states, the 9 months' volume is less than 4 per cent behind the 1924 total and is greater than the total for any year previous to 1924. New construction started in the 36 states from January 1 to October 1 has amounted to $4,327,008,700, an increase of nearly 29 per cent over the corresponding period of last year.

Russians Buying Glass Factory Equipment

A commission of Russians composed of P. S. Pavlov, engineer, and N. S. Rohlin, technical expert, representing the Himugol glass trust, and Prof. Philosophoff and F. J. Serebrakoff, technical expert for the Prodosilicat glass trust, are now in the United States to make a study of the operation of the Owens, Lynch and other machines, a number of which have been purchased for Russian glass bottle factories. Purchases of lehrs from the Simplex Engineering Company, Washington, Pa., tank blocks from the Ohio Valley Clay Company, Steubenville, O., and other equipment such as compressors, blowers, etc., have been made. About the middle of November, President Gurevich of the Himugol trust and General Manager Kivgillo of the Prodosilicat trust will also visit this country to investigate the glass business, especially pressed and blown ware, glass tubing, glasshouse refractories, and also porcelain and china, and additional orders will be placed for machinery and materials for use in these industries.

The commission makes its headquarters at the Amtorg Trading Corporation, 165 Broadway, New York, under the direction of J. V. Tourbim, who has charge in the United States of the Russian glass business, with J. P. Nikonow assisting. This organization represents in the United States the Union of Socialist Soviet Republics which is making extensive plans for rehabilitating the Russian glass industry during the coming year. Official information as to the projects planned includes at Ukraine (Donbas) a plant of five furnaces using coal for fuel, and 10 machines, probably Owens Graham flow or feeder type, for the production of bottles; in the Central District, Nijny Novgorod—five furnaces using oil fuel, 10 machines, probably Owens; Moscow—One furnace, wood fuel, two Lynch bottle machines; Southwest District, Novgorod—four furnaces, wood and peat fuel, 8 Lynch machines; Siberia—4 furnaces, 8 Lynch machines. Some equipment for other blown and pressed ware will also be required.

Inasmuch as the patent rights to use the Owens vacuum type of machine in Russia are held by a syndicate said to be controlled by German interests, sales of that type of machine for use in Russia cannot be made in this country. Partly for that reason the Russian authorities in placing contracts for the first two of the Owens machines, already ordered, selected the flow or feeder type and will probably specify this type in future orders.

Plate Glass Production Still Increasing

The total production of polished plate glass at all factories for the month of September, 1925, was 10,296,734 sq. ft., as compared with 10,328,029 sq. ft. in August.

The total production for the quarter ending September 30th was 30,553,176 sq. ft., or a little over 1,000,000 sq. ft. more than was produced in the second quarter of 1925, and 3,500,000 sq. ft. more than was made in the first quarter.

These are the figures issued by P. A. Hughes, secretary of the Plate Glass Manufacturers of America.

American Window Glass Company

At the annual meeting in Pittsburgh on October 20, W. L. Munro, president of the American Window Glass Company, presented the annual consolidated report of the American Window Glass Company, the American Photo Glass & Export Company and the Western Pennsylvania Natural Gas Company, which shows a net income for the year ended August 31, 1925 of $85,925 compared with $892,123 in the preceding year. Net profit from operations and other income amounted to $1,787,475 from which reserves were deducted for taxes, $38,014; royalties, $1,630,765 and other charges, $32,771. The surplus on August 28, 1925, was $10,704,378.

The company's output for the year was about 11 per cent greater than in the previous fiscal year. Sales during the past year were 35 per cent larger than in the previous year, but the total billing price was only 16 per cent higher. This was accounted for by several reductions made in selling prices.

Improvements which have been going on at the Jeannette factory were completed during the year and no further work of importance will be required there for a long time. Substantial reductions in costs were effected by improved equipment and methods. The board of directors were re-elected as follows: William L. Munro, Thomas F. Hart, J. D. Callery, A. E. Braun, George M. McCandless, G. C. Moore and H. N. Van Voorhis. The officers are: William L. Munro, president and general manager; Arthur E. Braun, vice-president; W. A. Esselstyn, treasurer and R. M. Speer, secretary and assistant treasurer.

Celebrates Seventy-fifth Anniversary

One of Philadelphia's oldest industries recently celebrated its seventy-fifth anniversary. It is the Pennsylvania Salt Manufacturing Company, maker of chemicals, which received its first charter September 25, 1850. At that time it had a capital of $100,000. Today its capital is $7,500,000. Since 1863 the company has had an unbroken dividend record, paying 12 per cent from that year to 1914, inclusive; 8 per cent from January 15, 1915, to April 15, 1917, inclusive, and 10 per cent from July 15, 1917, to date. In addition two extra disbursements of 1 per cent each have been made.

The company's plant at Greenwich Point, on the Delaware River, is one of the largest chemical plants in the Philadelphia industrial district. At the piers of the plants the company, the sole importer of Greenland cryolite, receives its shipments from the picturesque country in the north. The Greenwich plant was established in 1870, twenty years after the company started the operation of its first plant at Natrona, Pa. In addition to these two plants it also has operations at Wyandotte and Menominee, Mich.

Standard Plate Glass Company

The consolidated statement of Standard Plate Glass Company, Pittsburgh, Pa., as of June 30, 1925, shows total assets of $14,175,780, against $16,111,419 on June 30, 1924, and surplus of $286,475, comparing with $588,486.

Assets: Cash, $481,868; government securities, $764,609; accounts and notes receivable, $4,442,282; inventories, $2,326,346; investments, $1,067,897; deferred charges, $571,897; land, buildings, machinery, etc., less depreciation, $6,520,881; goodwill, $1,000,000; total, $14,175,780.

Liabilities: Accounts payable, $332,974; accrued taxes, interest, etc., $187,266; dividends payable, $121,794; gold notes, $3,000,000; reserves, $117,735; prior preference preferred stock, $1,968,300; preferred stock, $4,991,400; common stock (represented by 200,000 no par shares), $3,169,836; surplus, $286,475; total, $14,175,780.

Prominent Glass Men in Europe

A group of prominent electrical and glass men sailed for Europe on October 10. The party included L. A. Osborn, president of the Westinghouse International Company; Walter Cary, vice-president of the Westinghouse Lamp Company; F. Harold Smith, attorney for the Westinghouse Electric Manufacturing Company; A. A. Houghton, brother of Hon. A. B. Houghton, American Ambassador to the Court of St. James's and an executive of the Corning Glass Works, and A. D. Falck, also an exectuive of the Corning Glass Works. Other than to declare they were going on a business trip, the electrical and glass men had nothing to say of their plans abroad.

New Black Glass

A report from Japan states that after several years' investigation, Jusei Sugiye, a scientist of the Industrial Experimental Station of Osaka, is reported to have invented a black glass of a special kind which is expected to prove of great military value. It is said the black glass is opaque to all but ultra-violet rays and, by its use, battle formations or the movements of an enemy can be easily photographed in darkness without detection. Moving pictures, it is claimed, can also be taken in the dark by the use of the black glass.

Experiments with the new glass made recently in the presence of Rear Admiral Muto are said to have proved a complete success. The inventor declares the black glass will not only be important for military purposes, but that it will be found valuable in medical treatment.

Refractories Meeting

The American Refractories Institute is holding its fall meeting as this issue goes to press, October 29, at the Waldorf-Astoria Hotel. The program includes a number of technical papers and detailed discussion of the work of the institute.

The research division of the refractories fellowship at Mellon Institute, working in cooperation with advisory committees of technical men, is making a critical study of the existing tests for refractories and accumulating data on furnace conditions so that satisfactory specifications can be written.

A New Use for Glass

A glass vessel is used in connection with the Van Meter process of making poisonous gases for fumigating orchards or buildings with a minimum of risk. A paper cartridge lined with a thick layer of silicate is charged with a mixture of rice hulls and a powdered metal able to react easily with chlorine gas and give off a large quantity of heat. A glass vessel containing a mixture which also reacts with chlorine to produce the poison gas is imbedded in the contents of the cartridge. Chlorine passed through the apparatus into which the silicated cartridge is loaded causes heat to be liberated; the glass vessel then bursts and the disinfecting gas is set free.

Convicted "Glass Casket" Promoter Goes Free

Elmer W. Jarnecke, former confidential secretary of Gaston B. Means and defendant with him in the conspiracy charges growing out of Means's alleged extortion of more than $15,000 from defendants in the "glass casket" mail fraud cases, was recently given a suspended sentence by Federal Judge Bondy in the United States District Court.

Jarnecke turned Government witness and gave testimony which contributed to the conviction of Means, a former Department of Justice agent, who is serving a prison sentence at Atlanta, and Thomas B. Felder, an attorney and the other defendant in the case, who now is appealing a $10,000 fine assessed.

The plate-glass industry of Belgium has become unusually active and is now operating at 75 per cent of maximum capacity. Window glass output is equally satisfactory, with orders during the first 10 days of October considerably in excess of production during that period. Hand and mechanical plants are booked for three to four months ahead.—*Commerce Reports.*

The Ninth Annual Industrial Safety Congress and Exhibit of the New York State Department of Labor will be held in Syracuse, with headquarters at the Hotel Onondaga, November 30, and December 1, 2 and 3. An exhibit of safety equipment will be held in the ballroom of the Onondaga Hotel.

The American Society of Mechanical Engineers will hold its annual meeting in New York, November 30 to December 4,

1925. About forty-five papers will be presented. Secretary Hoover will be elected an honorary member. The Fuel and Power Section will deal with industrial furnaces, industrial power, refractories, etc.

Trade Activities

The Salem Co-operative Window Glass Company, Salem, W. Va., is reported to have reduced its capital from $65,000 to $975.

A new bottle factory is being erected at Freeport, Ill. The **W. T. Rawleigh Company,** of Freeport, is interested in the project. They are looking for an experienced plant superintendent.

The Independent Glass Company, Chattanooga, Tenn., has been incorporated with a capital of $10,000 by Edgar Hill and Charles Forbes.

The Kimble Glass Company, with main office at Chicago, Ill., and factory at Vineland, N. J., have increased their capital stock from $300,000 to $1,200,000.

Sandusky Glass Manufacturing & Supply Company, Sandusky, O., has resumed operations and when full capacity is reached will employ about 150 men.

It is reported that Morris Stultz, Redkey, Ind., has been appointed receiver for the **Baker Mould Company,** Dunkirk, Ind., manufacturers of glassmakers' molds.

The Acme Glass Company, Olean, N. Y., employing about 100 men, resumed operations the end of September, after being shut down for several weeks for necessary repairs to the plant.

The National Window Glass Company's plant at Huntington, W. Va., has resumed operations under the management of H. H. Vandegrift. About 250 men will, it is said, be employed.

The first furnace for the **Ford Motor Company's** new continuous flow plate glass factory at St. Paul, Minn., is now under construction by the Toledo Engineering Company, Nasby Building, Toledo, O., under the supervision of William G. Bergman.

In the October, 1925, issue of this journal an item mentioning the consolidation of the **Holophane Glass Company** and the **Holophane Illuminating Company** incorrectly gave the company's factory as being located at Lancaster, O. The factory is located at Newark, O.

The Brown Instrument Company, Philadelphia, Pa., the pyrometer manufacturers, announce the opening of the following offices: Indianapolis, Ind., 215 East New York street, in charge of J. R. Green, and Cleveland, O., Room 1108, Hippodrome Building, in charge of G. S. Frazee.

The McDonald Glass Company has been incorporated by Edwin W. Bryce, Garrett D. Bryce, Edwin A. Bryce, Alexander Tener and Kinley J. Tener, to manufacture and sell glass and glassware. Evans & Tener, 832 Oliver building, Pittsburgh, Pa., are attorneys for the company.

The General Electric Company has successfully concluded a twelve year litigation for the patent rights covering the modern vacuum tube used successfully in radio, X-ray and similar work. This tube is the invention of Dr. Irving Langmuir, assistant director of the company's research laboratory.

P. W. Schofield, general manager of the **Chicago Heights Bottle Company,** announces that while a tour of inspection has been made in and around Muncie, Ind., no definite plans have as yet been made regarding the securing of a plant to take the place of the factory which was destroyed by fire early in September, at Chicago Heights, Ill.

The Rosedale Foundry & Machine Company, Pittsburgh, Pa., who specialize in casting tables and other equipment for plate and rolled glass manufacture, suffered a heavy loss in the destruction of their pattern shop by fire on October 18. The company reports, however, that plant operations were not seriously interrupted and that prompt deliveries of orders are being made.

The General Glass Company, Geneva, N. Y., manufacturer of rolled and sheet glass, met with a heavy loss when its factory was partly destroyed by fire on October 13. It is reported that a reorganization of the company was being planned and that an effort will be made to obtain additional capital with which to put the plant into better condition to produce to full capacity.

D. A. Taylor, vice-president and treasurer of the **H. Northwood Company,** Wheeling, W. Va., has been named receiver of the company as the result of a suit brought by George E. House, one of the stockholders. It is reported that the company is solvent but over-stocked with goods that cannot be sold promptly except at a loss. It is believed to be the intention of those interested to continue the operation of the plant.

H. C. Fry, president of the **H. C. Fry Glass Company,** Rochester, Pa., and its largest stockholder and creditor, applied early in October for a temporary receiver and G. H. Gerwig and W. H. Green were appointed to take charge of manufacturing operations at the company's plant and also at the Beaver Valley Glass Company plant at Rochester which it controls. Under the new regime the officers of the company are as follows: H. C. Fry, president; W. H. Green, secretary and general manager; George H. Gerwig, treasurer; G. Kenneth Fry, sales manager, and H. Skillman Fry, production manager.

Industrial Publications

The Brown "New Design" Recording Pyrometer. A 10-page bulletin illustrating in colors the special features of this instrument, which was described in the September issue of this journal. It is a product of the Brown Instrument Co., 4513 Wayne avenue, Philadelphia, Po.

The Apex CO_2 Recorder and Indicator are described in bulletins Nos. 118 and 118-A, which are now ready for distribution by the Uehling Instrument Company, Paterson, N. J. These instruments operate on the orifice principle and do not employ chemical solutions. The principle of operation is fully explained in the bulletins.

American H. S. Fan, Bulletin No. 6103. American Blower Company, Detroit, Mich. A 32-page booklet in which this fan and all of its important details are illustrated and briefly described. Tables give data on R. P. M., B. H. P., outlet velocity and cubic feet per minute of all sizes from No. 4 to No. 15. Dimensions of the various parts of the different sizes of fans are also tabulated.

Insulation of Glass Manufacturing Equipment. Celite Products Company, San Francisco, Cal. This 8-page Bulletin No. 114 points out savings effected by proper use of insulating materials and outlines the modern practice of insulating high temperature equipment, such as lehrs, furnaces, regenerators and recuperators, gas producers, gas mains, pot arches, boilers, etc., describing these and other uses in glass factories for Sil-O-Cel insulating brick, concrete and powder. The information given on the insulation of continuous and day tanks is of special interest.

High Temperature Insulation. A lecture compiled by the Celite Products Company, San Francisco, Cal., for use in engineering departments of leading universities throughout the country. It contains data on the methods of heat transmission through heated walls with formulas for determining heat losses through walls composed of materials of various conductivities. Temperature gradients through typical walls are shown as well as information on the application of insulation to typical high temperature equipment, such as boilers, furnaces, kilns, and equipment used in the refining of petroleum and in the making of glass, steel, gas, etc. The lecture is illustrated with lantern slides but has also been made up in printed form (Bulletin No. 131) which contains all the illustrations shown on the slides. These copies are available for distribution to those interested in the subject.

The Republic Flow Meters Company, 2240 Diversey Parkway, Chicago, Ill., has arranged, in the interest of greater industrial efficiency, for a series of articles on ceramics, combustion, and heat treatment of steel, to be written by prominent consulting engineers. Those relating to ceramics will be the work of C. W. Parmelee, head of the Department of Ceramic Engineering, University of Illinois. His subject is Heavy

Clay Products—materials, methods and equipment controlling quality. The first article is entitled the Origin of Clays; the second will relate to the influence of the silica and alumina content on the properties of clay; the third will treat of the influence of alkalies, lime and magnesia; the fourth, on water content and its influence; and the fifth, iron content and its effect. Copies of these articles may be obtained as issued without obligation by writing to the Republic Flow Meters Company,

Judge F. P. Schoonmaker, in the United States District Court, yesterday handed down an opinion in the equity suit brought by the **American Window Glass Machine Company** and the **American Window Glass Company** against the Pittsburgh Sheet Glass Company, in which he held that the court could not find that the defendant concern had infringed on a patent held by the plaintiff companies.

National Directory of Commodity Specifications. This directory, which is issued by the Bureau of Standards with the cooperation of the Bureau of Foreign and Domestic Commerce, is now being distributed. The directory contains information regarding the best known specfications for more than six thousand commodities. It tells not only what specifications are in general use but also by whom they were prepared and where copies can be obtained. In it are conveniently indexed for ready finding about 27,000 specifications prepared by the Federal Specifications Board and the separate departments of the Federal government, by state and city purchasing agents, public utilities, technical societies, and trade associations.

The cost of printing and binding the book to the Government Printing Office is only $1.25. The price to the purchaser is the same. Copies may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C.

Personals

Edward Conover, who has been manager of the Arcadia, Ind., plant of the D. C. Jenkins Glass Company, Kokomo, Ind., is reported to have resigned from his position.

M. R. Scott is taking charge of the technical work at the Bausch & Lomb Optical Company's glass plant at Rochester, N. Y., succeeding R. J. Montgomery who, as previously announced, has become Lecturer in the new Ceramic Department of the University of Toronto.

James D. Lalor, formerly general manager of the Lalor Fuel Oil System Company, Baltimore, Md., announces that he is no longer connected with that organization. Mr. Lalor's present address is 3030 Edmondson avenue, Baltimore. The Lalor high pressure oil burning system is used in a number of modern glass factories.

Jules Bayet, of the Ste. des Cristalleries de Nancy, and André Griffon, representative of the company at 145 West 45th street, New York, are visiting several glass factories and investigating American methods and machinery for the manufacture of bottles and tableware. The company employs about 1,000 men at its plant at Nancy, France.

Deaths

William James, Sr.

William James, Sr., secretary and manager of the D. O. Cunningham Glass Company, bottle manufacturers, Pittsburgh, Pa., died at his home in that city on September 25. Mr. James who was 60 years of age, was connected with the Cunningham Company for about 38 years, having long been in charge of operations.

Coming Meetings

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS will hold its annual meeting in New York, November 30 to December 4, 1925.

THE FOURTH NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING will be held at the Grand Central Palace, New York, November 30 to December 5.

ASSOCIATED GLASS AND POTTERY MANUFACTURERS AND PITTSBURGH GLASS AND POTTERY EXHIBIT, January 11 to 30, 1926, at Pittsburgh.

AMERICAN CERAMIC SOCIETY annual meeting will be held at Atlanta, Ga., February 8-13, 1926.

THE STAINED GLASS ASSOCIATION OF AMERICA, formerly the National Ornamental Glass Manufacturers Association, will hold its next annual convention in the summer of 1926 in Washington, D. C., which will be followed by a trip to Europe.

What Our Advertisers Are Doing

The Russell Engineering Company, St. Louis, Mo., report the closing of a contract with the Atlantic Bottle Company for the repair of a 75-ton bottle furnace located at its Brackenridge, Pa., plant. The work includes the installation of the new Laclede-Christy patented "full depth" throat. The Russell Engineering Company has also recently completed and turned over to the Scohy Sheet Glass Company, at Sistersville, W. Va., an extensive installation for the manufacture of flat glass by the Fourcault process.

What the World Wants

(Specific inquiries for American goods received in the Dept. of Commerce)

Mexico. 17116, glass crystals for watches.
Germany. 17117, glass (mirrors); 16928, glass-blowing, beveling, polishing machines, etc.
South Africa. 17081, glassware, kitchen, such as bottles, jars and baking dishes.
East Africa. 16966, glass for mirrors and pictures.
Venezuela. 17280, window and mirror glass; 17278, glassware; 17281, light and cheap glassware; 17364, glassware; 17454, glassware.
Trinidad. 17359, glassware.

Inquiries Received

(*For Further Information Address* THE GLASS INDUSTRY)

293. Can you give us the names of manufacturers of what is known as a fountain or reservoir glass sponge cup? (Oct. 17.)
294. Kindly give me the name of glass factories specializing in novelties. (Oct. 8)

Glass Stock Quotations

Reported by Moore, Leonard & Lynch, Union Trust Building, Pittsburgh, Pa.

PITTSBURGH STOCK EXCHANGE, OCTOBER 23, 1925

	Bid	Asked	Last
American Window Glass Machine, com.....	78	79	78
American Window Glass Machine, pfd.....	92	93	94
American Window Glass, preferred.....	111	112	111½
United States Glass.....	16⅜	16½	16½
Pittsburgh Plate Glass.....	283	285	285
Standard Plate Glass, common.....	6½	7	6¾
Standard Plate Glass:			
Preferred cumulative	36	38	40
Prior	80	81	80

Glass stocks on the Pittsburgh Stock Exchange ruled unchanged to lower in the October trading. Competition, now making itself felt in the glass industry, is tending to weed out the inefficient high cost producers.

WHEELING STOCK EXCHANGE, OCTOBER 23, 1925

Hazel Atlas	39	40	40
Imperial	—	75	72
Fostoria	140	—	150
Central	75	—	80

Wheeling Stocks showed a slightly firming tendency in the later trading this month. Hazel Atlas is operating about 85 to 90% capacity.

TOLEDO STOCK EXCHANGE, OCTOBER 23, 1925

Owens Bottle Machine, common.....	61	62	62
Libbey-Owens Sheet Glass, preferred.....	114	115	—
Libbey-Owens Sheet Glass, common.....	207	209	—

Current Prices of Glass-Making Materials

Quotations furnished by various producers, manufacturers and dealers.

October, 23, 1925

		Carlots	Less Carlots
Acid:			
Citric	lb.	.42	.46
Hydrochloric (HCl) 20° carb. ext. per 100	lb.	1.65	2.00
Hydrofluoric (HF) 60% (lead carb.)	lb.	..	.13½
52% and 48%	lb.	..	.10-.11½
Nitric (HNO_3) 38° carboy ext. Per 100 lb.		.05	5.25-6.00
Sulphuric (H_2SO_4) 66°	ton	15.00	18.00
Tartaric	lb.	..	.29
Alcohol, denatured	gal.	.50	.55
Aluminum hydrate ($Al(OH)_3$)	lb.	.06	.07
Aluminum oxide (Al_2O_3)	lb.	..	..
Ammonium fluoride (NH_4F)	lb.	..	.23
Ammonia water (NH_4OH) 26° drums	lb.	..	.05
Antimony, metallic (Sb)	lb.	..	.18
Antimony oxide (Sb_2O_3)	lb.	..	.18
Antimony sulphide (Sb_2S_3)	lb.	..	.18
Arsenic trioxide (As_2O_3) (dense white), 99%	lb.	.03¾	.04
Barium carbonate ($BaCO_3$)			
Precipitated	ton	44.00–50.00	47.00–54.00
Natural powdered	ton	42.00–44.00	45.00–46.00
Natural, powdered, imported	ton	38.00	..
Barium hydrate ($Ba(OH)_2$)	lb.	..	.05
Barium nitrate ($Ba(NO_3)_2$)	lb.	.07¼	.08
Barium selenite ($BaSeO_3$)	lb.	..	..
Bone ash	lb.	.05½	.06½
Borax ($Na_2B_4O_7 10H_2O$)	lb.	.04¾	.05-.05½
Boric acid (H_3BO_3)	lb.	.09	.09¾
Refined	lb.	.10	.10½
Cadmium sulphide (CdS)—			
Red	lb.	..	1.25
Orange	lb.	..	1.10-1.25
Yellow	lb.	..	..
Chromium oxide (Cr_2O_3)	lb.	.30	.32
Cobalt oxide (Co_2O_3)			
In bbls.	lb.	..	2.10
In 10 lb. tins	lb.	..	2.20
Copper oxide			
Red (Cu_2O)	lb.	.	.30
Black (CuO)	lb.	..	.25
Black prepared	lb.	..	.30
Cryolite (Na_3AlF_6)		..	.09⅛
Epsom salts ($MgSO_4$) (imported) Per 100 lb.		..	1.40
Feldspar—			
100 mesh	ton	12.00–20.00	16.00–22.00
80 mesh	ton	..	..
40 mesh	ton	..	..
Fluorspar (CaF_2)—			
Powdered white, 95%	ton	40.00	..
" " 90%	ton	38.00	..
Formaldehyde	lb.	.08¾	.09½
Graphite (C)	lb.	..	.04-.07
Iron oxide—			
Red (Fe_2O_3)	lb.	..	.02
Black (FeO)	lb.	..	..
Kaolin (f.o.b. mine)	ton	10.00	..
English, lump, f.o.b. New York	ton	14.00-23.00	..
Lead chromate ($PbCrO_4$)	lb.	..	..
Lead oxide (Pb_3O_4) (red lead)	lb.	.12¼	.12¼-.12½
Litharge (PbO)	lb.	.11¾	.11¾-.12
Lime—		Carlots	Less Carlots
Hydrated ($Ca(OH)_2$) (in paper sacks)	ton	12.00–12.50	..
Burnt (CaO) ground, in bulk	ton	9.00–10.00	..
Burnt, ground, in paper sacks	ton	11.00	..
Burnt, ground, in 280 lb. bbls.	Per bbl.	2.15	2.30
Limestone ($CaCO_3$)	lb.	..	..
Magnesia (MgO)—			
Calcined, heavy	lb.	..	..
Light	lb.	..	..
Magnesium carbonate ($MgCO_3$)	lb.	.03¼	.03½
Manganese 85% (MnO_2)	lb.	.03½	.03¾
Nickel oxide (Ni_2O_3), black— for nickel content	lb.	..	.35
Nickel monoxide (NiO), green— for nickel content	lb.	..	.35
Plaster of Paris, bags	ton	..	19.00
Potassium bichromate ($K_2Cr_2O_7$)—			
Crystals	lb.	.08½	.08¾
Ground	lb.	.11	.12
Potassium carbonate—			
Calcined (K_2CO_3) 96-98%	lb.	.06½	.06¾
Hydrated 80-85%	lb.	.05¾	.06
Potassium chromate (K_2CrO_4)	lb.	..	..
Potassium hydrate (KOH) (caustic potash)	lb.	..	.07⅛-.07⅝
Potassium nitrate (KNO_3) (gran.)	lb.	.06⅛	.06⅜
Potassium permanganate ($KMnO_4$)	lb.	.15	.16
Powdered blue	lb.	..	.24-.28
Rochelle salts, bbls.	lb.	..	.20
Rouge	lb.	..	..
Rutile (TiO_2) powdered, 95%	lb.	.20	.25
Salt cake, glassmakers (Na_2SO_4)	ton	20.00	23.00
Selenium (Se)	lb.	..	2.10
Silver nitrate ($AgNO_3$)	oz.	..	.49⅛
Soda ash (Na_2CO_3) dense, 58%—			
Bulk	Flat per 100 lb.	1.35-1.40	..
Bulk, on contract	Flat per 100 lb.	1.35	..
In barrels	Per 100 lb.	1.69	2.40
In bags	Per 100 lb.	1.45	..
Spot orders	.05 per 100 lbs higher		
Sodium bichromate ($Na_2Cr_2O_7$)	lb.	.06½	.07
Sodium hydrate (NaOH) (caustic soda)	Per 100 lb.	3.20	3.90
Sodium nitrate ($NaNO_3$)—			
Refined (gran.) in bbls.	lb.	.03⅞	.04⅛
95 per cent	Per 100 lb.	2.55	2.75
Sodium selenite (Na_2SeO_3)	lb.	..	..
Sodium fluosilicate (Na_2SiF_6)	lb.	..	.04¾
Sodium uranate (Na_2UO_4)	lb.	..	1.15
Sulphur (S)—			
Flowers, in bbls.	Per 100 lb.	3.35	3.65-3.90
Flowers, in bags	Per 100 lb.	3.00	3.30-3.55
Flour, heavy, in bbls.	Per 100 lb.	2.50	2.80-3.05
Tin chloride ($SnCl_2$)) (crystals)	lb.	..	.41
Tin oxide (SnO_2) in bbls.	lb.	..	.64
Uranium oxide (UO_3), 100 lb. lots	lb.	..	1.15
Zinc oxide (ZnO)	lb.	.07½	.07¾

Monthly Summary of United States Foreign Commerce in Glass

EXPORTS

Corrected to September 24, 1925

	August 1924 Quantity	August 1924 Value	August 1925 Quantity	August 1925 Value	Eight Months Ending August 1924 Quantity	Eight Months Ending August 1924 Value	Eight Months Ending August 1925 Quantity	Eight Months Ending August 1925 Value
Glass and glass products (total)	.....	$673,659	.....	$697,688	.....	$5,885,738	.....	$5,785,680
Plate and window glass—								
Window glass, common, box 50 sq. ft.	2,596	12,577	1,729	8,522	27,436	123,233	18,114	103,251
Plate glass, unsilvered, sq. ft.	110,049	31,386	103,586	29,454	1,325,099	382,305	954,622	265,221
Other window and plate glass, n.e.s. lbs.	241,064	25,510	284,502	37,201	1,411,732	153,003	1,457,800	175,099
Glass containers (bottles, vials and jars) lbs.	6,211,155	255,069	3,730,694	199,904	41,170,184	1,953,888	44,265,819	2,007,990
Table glassware, plain lbs.	1,226,290	124,297	1,394,382	140,606	10,540,453	1,162,133	11,339,637	1,154,352
Table and other glassware, cut or engraved lbs.	34,179	11,039	61,638	14,672	319,913	96,687	356,689	102,043
Glassware for lighting—								
Lamp chimneys and lantern globes lbs.	194,294	35,558	200,790	37,512	1,389,479	257,904	1,346,064	239,772
Globes and shades for lighting fixtures lbs.	93,156	30,603	130,277	46,284	833,709	257,555	1,045,126	320,789
Lamps and other illuminating devices, chiefly of glass lbs.	58,241	19,340	97,070	16,119	699,085	200,958	593,411	152,248
Chemical glassware lbs.	22,106	17,311	20,518	20,313	143,047	118,118	149,101	124,125
Electrical glassware, except for lighting lbs.	131,657	12,818	185,338	23,917	1,829,062	173,089	2,088,053	187,066
Other glassware, n.e.s. lbs.	383,984	98,151	685,718	123,184	6,143,626	1,006,865	5,018,755	953,724

IMPORTS

Corrected to September 24, 1925

Glass (total)	.....	$1,389,215	.....	$1,482,700	.....	$13,459,797	.....	$11,639,218
Cylinder, crown and sheet—								
Unpolished, lbs. dut.	3,676,370	188,642	2,934,816	161,515	23,143,310	1,329,316	33,301,476	1,762,681
Bent, ground, beveled, colored, painted, etc., and polished dut.	.....	25,932	.....	43,111	.....	339,416	.....	386,618
Plate Glass—								
Unsilvered, sq. ft. dut.	1,006,240	547,071	1,031,639	510,259	12,359,253	7,663,684	11,023,760	5,299,875
Fluted, rolled, etc., or silvered, or containing wire netting, sq. ft. dut.	104,732	14,840	142,897	23,377	1,969,337	245,708	855,029	132,749
Containers—bottles, vials, etc. dut.	.....	5,291	.....	14,529	.....	142,440	.....	117,133
Table and kitchen utensils, lbs. dut.	81,988	16,996	93,161	21,929	585,890	121,180	348,051	80,365
Glassware, cut or decorated, lbs. dut.	359,842	163,376	434,013	236,500	2,311,346	1,097,185	2,503,106	1,343,813
Blown glassware, n. e. s., lbs. dut.								
Bottles, ornaments, etc., lbs. dut.	575,152	181,394	699,642	219,232	3,161,951	1,016,142	2,295,671	735,374
Bulbs or electric lamps, number dut.	2,426,771	29,770	512,229	8,926	10,236,519	144,638	12,402,195	129,107
Chimneys, globes, shades, etc., lbs. dut.	333,432	82,186	315,611	77,571	3,026,504	538,679	3,374,412	725,571
Articles and utensils for chemical, scientific, and experimental purposes, lbs. dut.	99,403	35,623	109,118	41,112	658,302	223,678	622,848	217,793
Other glassware dut.	.....	98,094	.....	124,639	.....	597,731	.....	708,139